IROLI SUKHOI SU-26 PLAN INSIDE!

MODEL AIRPLANE NEWS

48120

January 1994

2nd Annual 4-Stroke SCALE EXPO

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Great Planes SWEEPSTAKES over $4,500 in prizes!

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rism Programmable Radio • Shock-Absorbing Landing Gear

JANUARY 1994 VOLUME 122, NUMBER 1

MODEL AIRPLANE NEWS

75
BONUS! PLANS DIRECTORY AND SUKHOI SU-26 PLAN

FEATURES

ABOVE: *this 1964-vintage Aircoupe built by Walt Price of Vacaville, CA, flew at the 2nd Annual Four-Stroke Scale Squadron Expo. (Photo by Jerry Nelson.)*

ON THE COVER: *first shown on the cover of Model Airplane News in November 1929, this Jean Oldham cover reminds us of a time when many more youngsters were involved in aeromodeling. Has your club put on any exhibitions for local schools or scouts?*

FEATURES

CONSTRUCTION

COLUMNS

COLUMNS

DEPARTMENTS

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EDITORIAL

TOM ATWOOD

POWER AND SPEED AT MADERA

You're a reporter on the flight line at the '93 Madera Unlimited R/C Air Races. About 60 feet to your left, the crews for five unlimited racers await the word to start their engines. The planes have wingspans of nearly 8 feet and displacements ranging from 4.4ci to nearly 12ci! Some crew members nervously joke with teammates; others display a look of intense concentration. All have earned their way here through a combination of teamwork and supremely focused effort.

The crowd, with all eyes glued on the flight line, is a few hundred feet behind you. The edge of a 150-foot-wide airport runway is only a few feet in front of you. Pylons 1 and 2, which define the outer bounds of the ¾-mile course are 1,600 feet apart to your far right and far left. In a pre-flight test, the green, red, white, yellow and blue pylon lights all shine at once. The judges complain that some of the pylon lights are obstructed by photographers. You are permitted to remain, but you have to crouch in the soft, almost powdery soil. Then the defining moments begin; the crews are told to start their engines.

Kent McKenna smiles as he basks in the glory of winning first place gold at Madera with his scratch-built Lancair IV.

It sounds like a bunch of Harleys being kicked over. The ground beneath you trembles (you realize you should have brought earplugs). The pace plane, flown by Nick Ziroli, has been in the air for some seconds. Then, with a deafening roar, the planes roll out onto the runway, one by one, each pulling a rather fragile-looking helper behind it. In seconds, the planes are at altitude on the far side of the course, bunched behind the pace plane. The formation heads counter-clockwise to the left toward pylon 2. The pace plane peels away to the right, and you hear, over the PA system, "Gentlemen, you have a race."

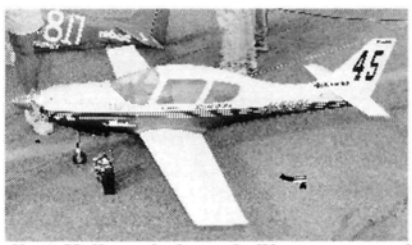
The racers hurtle downward toward pylon 2 in a gambit to gain speed and advantage. Rounding the pylon, the planes head toward the pilot boxes (and you) in knife-edge. After swinging back over the runway and rolling to upright, they roar past the start/finish line in front of you at 150 to 170mph, some stacked in close formation. Some are not 50 feet off the deck. They sound like fighter planes in a WW II movie. Your heart pounds as the adrenaline pumps into your blood. The planes bank around the pylon on the right, some of them nearly touching wingtips. The grandeur and drama of the sport of unlimited racing has hit you full bore. You grab your camera and start to track the racers—the reason you are here (something that you had momentarily forgotten).

We will have a full report on the recent Madera races in our next issue.

A flight-line view as the Silver AT-6 Trophy race begins at Madera '93. Race number 444, piloted by Norbert Gruntjen of Germany, took first. (Norbert was sponsored by MAC's Products, R/C Country Hobbies and RacePro Engineering.)

LOOK OUT FOR...

• **1994 Madera Unlimited R/C Air Race.** At any of these events, there's a lot more to see than just the racing. Wander through the pits, and you'll see some remarkable emerging technology. The '93 Madera Unlimited R/C Air Race was the biggest yet, with approximately 200 planes entered. In '94, there are plans to add a Formula 1 Class to the competition as well. The event is tentatively scheduled for the last week in September. For details, call the Unlimited at (310) 320-8369; fax (310) 320-8354.



Kent McKenna's Lancair IV was powered by an Aerrow 200. Its low-drag design gave it a speed advantage.

• **1994 Texas Unlimited Air Races & Air Show.** This will be held on May 10 through 15 at the Galveston Municipal Airport. This race is receiving the full support of the city of Galveston, and it promises to be a major event—"Texas style." The organizers plan to introduce Giant Scale Golden Era racing in '94 and to hold Thompson Trophy Class races in '95. Call (713) 391-4799.

• **Radio Controlled National Championship Air Races®.** This—the second annual event here—will be held in Reno, NV, on June 2 through 5 at Stead Airfield (home of the full-scale Reno races). For more information, contact the Reno Unlimited Model Air Racing Association (RUMARA) at (702) 677-0869.

• **The Aviation Expo** will hold AT-6 races on August 3 through 7, 1994, just outside Ankeny, IA. For more information, call Aviation Expo at (515) 965-9082. ■

AIRWAVES

WRITE TO US! We welcome your comments and suggestions. Letters should be addressed to "Airwaves," **Model Airplane News,** 251 Danbury Road, Wilton, CT 06897. Letters may be edited for clarity and brevity. We regret that, owing to the tremendous numbers of letters we receive, we cannot respond to every one.

ERRATA

In our June '93 issue, we published a review of the Northrop Gamma Hawk Racer. The address and telephone number of Aero Classics Mfg. Co. should have been: 102 Justice Ln., Lonoke, AR 72086; (501) 676-2022.

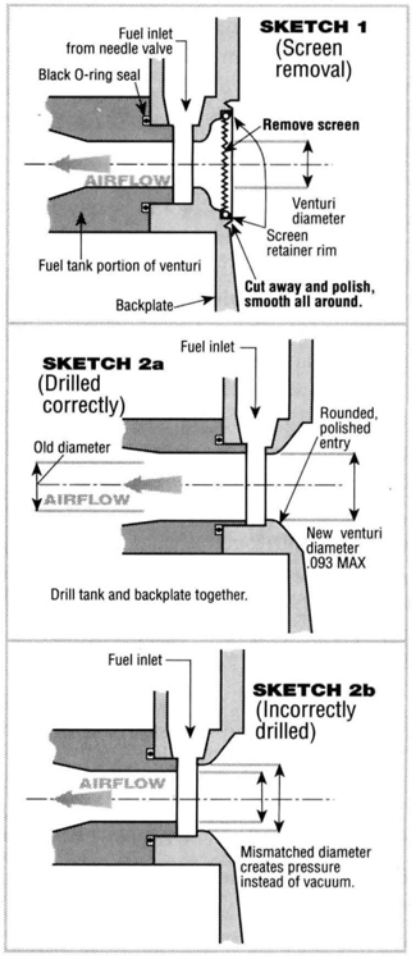
In the November '93 issue, the "Joe Nall Memorial Fly-In" article should have listed James George's telephone number as (318) 396-7081.

COX .049 MOD

I'm 13 and a dedicated subscriber. I also plan to keep subscribing, but I was recently greatly discouraged. In the June '93 issue of *Model Airplane News,* I was very interested in the article by Randy Randolph on improving the performance of the Cox Black Widow .049 engine. I very willingly took this article to heart, bought the right size drill bit and went to work on improving my engine. Then, in the August issue, Larry Renger [Director of Engineering at Cox] indicated that the information given by Randy Randolph was incorrect, and the modification didn't help the engine. I was displeased to find this out, and I'm curious to know what actions you will take to correct the inconveniences this article has caused me.

JORDAN VARON
Tustin, CA

Jordan, we do the best we can to provide accurate information, but that doesn't mean that every article in our magazine—or in any magazine, for that matter—contains the complete story in every detail. Moreover, when there is more to the story and we feel readers can benefit from it, we do everything we can to provide that information on a timely basis. Randy Randolph stands by his recom-mendation, so we asked Larry Renger to give us more detail on how to approach the modification. He sent us the following diagrams and commentary. You may need to buy a drill bit of a different size, but the modification can still be made and your investment saved. TA



To clarify the technique for removing the screen and/or drilling the venturi on a Black Widow Engine, here is what I know about it:

First, removing the screen will give a slight boost in rpm, especially if the screen is gooey with old castor oil and dirt. The downside is that there's a significant risk of getting junk stuck under the reed valve. If you remove the screen, you should also remove the little rim that holds the screen in place. (See Sketch 1.)

Second, as far as drilling the venturi, the original Black Widows had 0.060-inch-diameter venturis like the Golden Bee and the Babe Bee. They used to be drilled out to increase rpm. Modern Black Widows already

venturi, and that is about as far as you can go and still get fuel draw in maneuvers. For straight and level racing, you could go to about .093. You sacrifice easy needle-valve setting and run time if you open up the venturi.

See Sketch 2. The proper way to drill the venturi is to drill the backplate and the tank together so that the bore is smooth and concentric (Sketch 2a); the wrong way is to bore out only the backplate. If you do this, you'll have failed to increase the minimum diameter of the flow path, and you'll have created a pressure point exactly where you want *minimum* pressure to draw fuel (Sketch 2b).

LARRY RENGER
Director of Engineering,
Cox Products Inc.

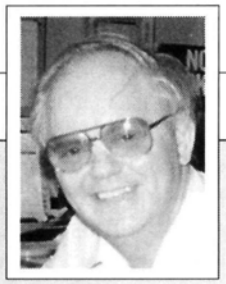
FINDING A FIESELER

I hope that you can help me. I've been looking for a kit or some plans for the Fieseler Fi156 Storch or the Morane-Saulnier Cricket, which is the French-built version. If you don't know of any plans or a kit, but if you know someone who has built one, I'd like their address. Keep up the good work.

JEFF SCHROEDER
Muldrow, OK

Jeff, with its unique appearance and its STOL capabilities, the German Fieseler Storch would make a wonderful model. A 1/6-scale version with a 70-inch wingspan designed by Dennis Bryantis available from Bob Holman Plans, P.O. Box 741, San Bernardino, CA. The Elite (plans no. 8) costs $30 plus $5 S&H. In Bob's latest catalogue, he states that he'll also have a 96-inch-span version of the Storch soon—just the ticket for IMAA fun flys. For good scale documentation, Bob Banka's Scale Model Research (3114 Yukon Ave., Costa Mesa, CA 92626) has many photo and documentation packages available on this aircraft. With these two resources, you're well on your way to building a beautiful model. GY■

HINTS & KINKS



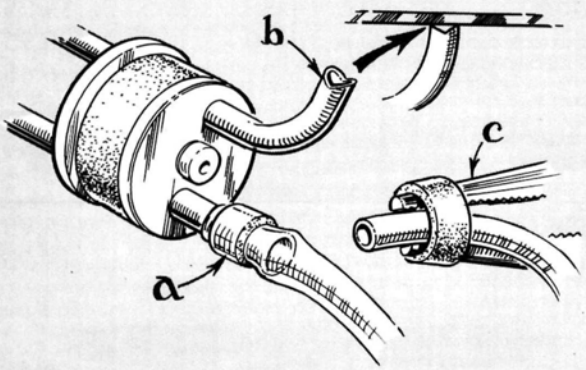
JIM NEWMAN

Model Airplane News will give a free one-year subscription (or one-year renewal if you already subscribe) for each idea used in "Hints & Kinks." Send a rough sketch to Jim Newman c/o Model Airplane News, 251 Danbury Rd., Wilton, CT 06897. BE SURE YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO AND NOTE YOU SUBMIT. Because of the number of ideas we receive,we can't acknowledge each one, nor can we return unused material.

LONG SANDING BAR

To make a long, straight sanding bar, attach a strip of sanding-belt paper to the edge of a long spirit level using rubber cement.

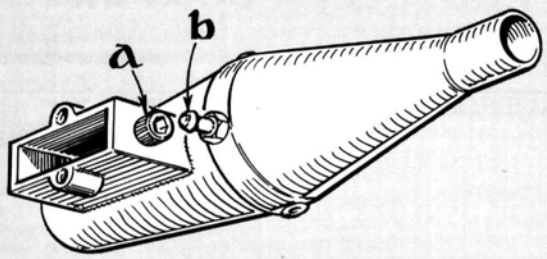
Walter Suchma, Bordentown, NJ



NON-SLIP CLUNK LINE

Flare the brass tube inside your fuel tank by tapping a center punch gently into it. Use 400-grit sandpaper to remove the sharp edges, rinse the tube with alcohol, and then press the fuel line onto it. Using long-nose pliers (c) as a stretcher, slip a collar—a piece of slightly wider tubing (a)—over the fuel line and pull it forward against the flared end of the tube. If you cut a notch in the vent tube (b), the vent line won't be pinched if it's forced against the top of the tank.

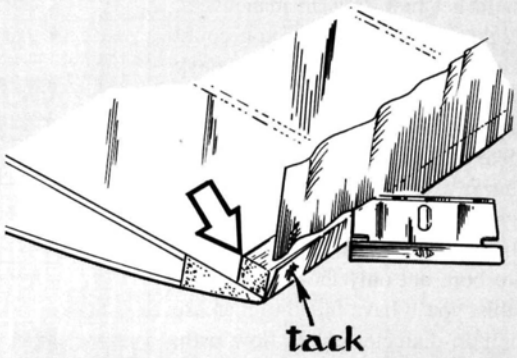
Rene Mapua, Manila, Philippines



BETTER WEBRA PRESSURE

Remove the pressure fitting (a) and plug the hole with a cap-head screw. Drill a hole through one of the rivets (b) using an 1/8-inch drill bit, then screw the pressure fitting into the hole. Be sure to use Loctite on the screw and the fitting. The change in pressure will improve idling and pick-up, especially in Promix and Dynamix carburetors.

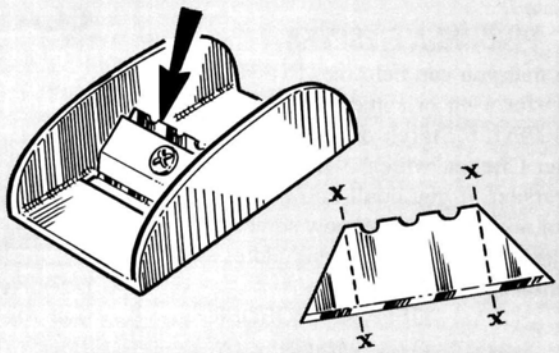
Yaron Koriat, Barkan, Israel



NEATER MONOKOTE SEAMS

On the edge of your covered wing, place a balsa stick that's as wide as the seam you'll need. Pull the film up against the stick, heat-tack it at each end, and run a sharp blade along the top edge of the strip to make an even, neat flap. Remove the stick, and iron the flap onto the wing.

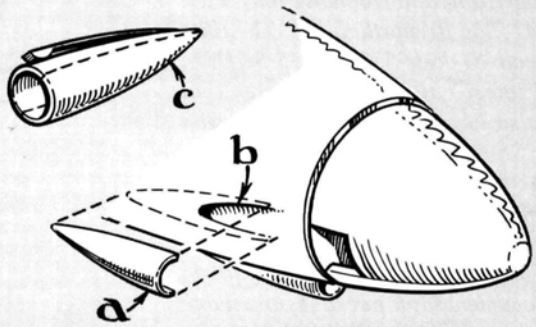
Jon Putnam, Tualatin, OR



BETTER BALSA PLANER BLADE

Heavy-duty utility-knife blades are inexpensive, and they do a better job than typical, flexible, single-edge razor blades. Remove the ends of a heavy-duty blade at the X's so that it's the same length as an ordinary blade. (Wear safety glasses for this!) Then clamp it into the plane. The blade is sharp, and better still, it can be honed.

Daniel Simenson, Oak Harbor, WA

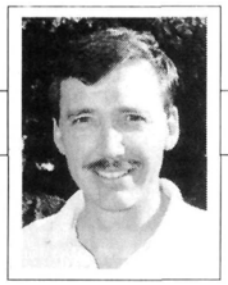


BATTERY COOLING INTAKES

To make air intakes to cool your electric R/C battery pack, glue a pushrod exit fairing (a) over each hole (b). If you can't find fairings, slit a pen cap (c) down the middle and use the halves.

Bill Wolfe, Hastings, MI

SIMPLE PROGRAMMING



DAVID C. BARON

HITEC'S NEW PRISM RADIO

WITH THIS "computerized" PCM (and/or PPM) radio—the Prism 7—Hitec* has become the latest manufacturer to enter the programmable-radio market. They've done this in a very stealthy way by having their new radio on hand and ready to ship before they even began to advertise. This is an intriguing strategy compared with the practices of other importers, who advertise a new radio as soon as they're confident it's on the way, yet long before it's available. Sometimes, we modelers are left waiting for equipment ordered from our favorite hobby supply shop while the manufacturers overcome all the design and production hurdles before floating a single radio across the Pacific. We can really appreciate what Hitec has done.

Here's Hitec's new Prism radio. It offers powerful programming capability at a price below that of radios with similar capability.

BREAKS THE PRICE BARRIER

Hitec's new radio is a winner for another reason, too. Its low list price smashes the price barrier for programmable radios. It should cost considerably less than comparable radios—even after they've been discounted at the hobby shop!

Another plus is that it's fully interactive. This means that you can see your programming changes immediately. Moving the control sticks moves the servos and, hence, the control surfaces, without any need to perform a "save" sequence or return to a "run" mode.

The instruction manual is short, but it's one of the best-written that I've seen. It contains numerous hints and suggestions on how different functions can be used with different types of aircraft. For instance, it suggests different setups for the PCM fail-safe function for sailplanes, sport planes and pattern models. When the operator's manual offers these kinds of recommendations, it helps the modeler envision how a system works.

SPECIFICATIONS

Manufacturer: Hitec
Model: Prism 7
No. of channels: 7
Transmission mode: PPM or PCM
No. of model memories: 3
Receiver: dual-conversion FM ("Supreme Series" RCD 3500).
Servos: HS-422 Oilite bushing); torque—43.4 oz.-in.; speed—.20 sec./60 deg.; weight—1.6 oz. each.

Comments: this radio offers all the functions of a fully programmable radio at a much lower price. The functions include exponential and trim memories, fail-safe mode in PCM and landing attitude mixers.

Hits
- The trim functions are extremely thorough—more so than any I've seen.
- The simple, flexible timer function allows count-up and countdown.
- The manual is concise, well-written and full of helpful hints.

Misses
- The radio lacks an open programmable mixing function.
- The small display screen can be confusing.

INITIAL MODE

The Prism 7 has a two-stage programming tree that will be familiar to modelers who have experience with the JR* 347 or 388. The first section of the programming system is called the "Initial Mode." To access it, press the "up" (UP) and "down" (DN) keys while turning on the radio. The Initial Mode controls:

SEL. This is a three-memory model-select function.

CPY. The copy program allows you to duplicate an already successful setup to save time during your next setup.

XXX. This timer allows you to set the time in minutes and seconds. You then set the function for either count-up or countdown.

9.6. This display shows the current voltage and also allows PPM-PCM selection.

OFF and **Mixing Mode.** These represent the mixing-selection function that allows you to choose your wing configuration. (If a mixing mode hasn't yet been selected, the display will read "OFF.") Once you're in mixing mode, the "plus" and "minus" keys let you rotate through these mixes: **VtL** (V-tail); **ELE** (elevon); **dIF** (differential ailerons); and **FLP** (flaperons).

St1 or St2. These are for changing stick control from Mode 1 to Mode 2.

RST. The reset sets the radio back to factory default settings.

MAIN EDIT MODE

To access this mode, press the "up" and "down" keys with the radio already on. You'll then have access to these functions:

EPA. Endpoint adjustment gives you 125 units of throw available in each direction from neutral.

D/R. The dual-rate function allows the pilot to set the direction in which the switch is thrown for high rates.

NOR/REV. These are servo-reversing switches (for normal and reversed).

Sub-trim. This allows you to change

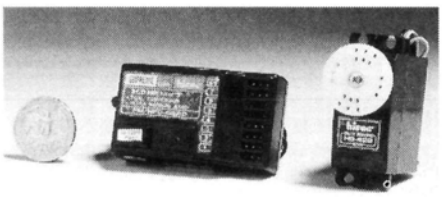
neutral electronically, i.e., without shifting the mechanical trim levers.

Trim rate. With this function, you can manipulate the amount of servo movement that results from a given amount of trim lever movement.

Trim memory. If you're setting up a second or a third model, this function enables you to transfer trim settings easily from one to another.

Trim reset. The reset returns the trim settings of the selected model to factory settings.

SNP ROL. The snap-roll function allows you to preset control throws and their directions for consistent snap rolls and spins.



The RCD 3500 FM receiver and one of the Oilite-bushed servos that came in the radio package.

FLP. The flap-adjustment function allows you to manipulate the extent of deployment of the surface controlled by channel 6 (flap). This is especially useful while using the flaperon function. You can use channel 6 as a trim control for the flaperons when using the landing mode as a flap-deployment control.

Flap-elevator mixing (Landing mode; LD ON/OFF). This function is for flap-elevator mixing when landing. Use the "up" or "down" key in the Main Edit menu to find the option screen. Flipping the "Landing" toggle switch activates or deactivates this function for channels 2 and 6. A single switch deploys a preset amount of flaps and an elevator deflection that will keep the plane in trim. The aircraft should be flown first to determine the degree and direction of elevator trim changes.

Flaperon landing mixing (LD ON/OFF). Access this option by returning to the Initial Mode menu and accessing the display screen for Mixing Select. When flaperons are activated, the ailerons become flaps and can also be manipulated using the "LD" switch.

DIF FLP. Differential flap (channels 1 to 6) allows you to manipulate flaperon throws to compensate for adverse yaw or to achieve a more axial roll. Individual servo direction can be manipulated to accommodate any servo installation. This function must be turned on first in the Initial Mode.

DIF. Differential ailerons (channels 1 and 7), without flap control, is available to control adverse yaw as well as to trim for more axial roll motion. This function must be turned on first in the Initial Mode.

FLS. All modern PCM-equipped radios offer a fail-safe system. You, the pilot, can select the safest combination of settings for each channel in the event that the signal is lost.

CONCLUSION

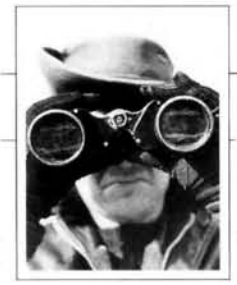
The Prism comes with an 8-channel "Supreme Series" RCD 3500 FM receiver that's said to be much improved over the popular "bulletproof platinum" receivers. The 3500 will also be available independently. Hitec informs us that a PCM receiver for the Prism radio will be available in March '94.

The Prism has all the features necessary to compete with nearly any other programmable radio. It's even more outstanding when the price is considered. Hitec has done a fine job with this product.

See you next month.

**Here are the addresses of the companies mentioned in this article:*
***Hitec/RCD,** 10729 Wheatlands Ave., Ste. C, Santee, CA 92071.*
***JR Remote Control;** distributed by Horizon Hobby Distributors, P.O. Box 3726, Champaign, IL 61826.* ■

AIR SCOOP

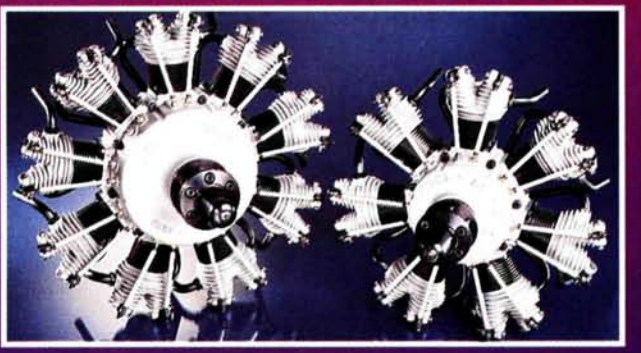


CHRIS CHIANELLI

New products or people behind the scenes; my sources have been put on alert to get the scoop! In this column, you'll find new things that will, at times, cause consternation, and telepathic insults will probably be launched in my general direction! But who cares? It's you, the reader, who matters most! I spy for those who fly!

PROCTOR MOTORS

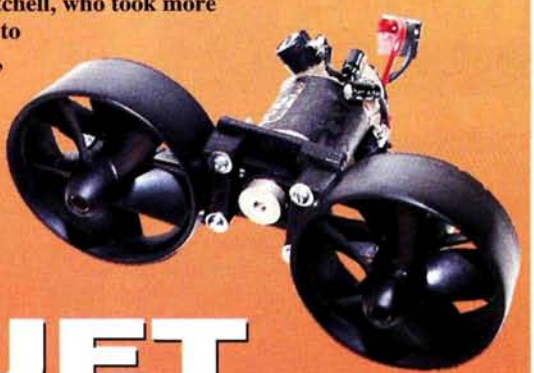
On the right, we have the new Seidel Series II 7- and 9-cylinder radial engines. The Series II engines feature tubular pushrods, a re-profiled cylinder and a new hub assembly that's scale for many "golden age" and WW II aircraft. Displacement for the 7-cylinder is 4.17ci, while the 9-cylinder is 5.80ci. The Seidel Series I engines will be available unchanged.



Laser has introduced three new 4-strokers: the 70, 80 and 100 (shown on the left). All use the proven "wedge"-shaped combustion chamber with valves inclined to the rear to reduce the detonation that's often associated with 4-strokes. All Laser engines have twin piston rings, plated cylinder liners, twin cam shafts and replaceable valve guides. The cylinder head and crankcase are machined out of solid-aluminum bar stock for strength. Incidentally, Laser has been doing quite well in competition: they took the first, second and fourth spots at the World Scale Champs in Muncie, IN, and, on the European scene, the top *seven* spots at the British Nationals and the top three spots at the trials for the European Champs in Finland—not bad! For more information on these engines, contact Proctor Enterprises, 25450 N.E. Eilers Rd., Aurora, OR 97002; (503) 678-1300; fax (503) 678-1342.

E-JET Breakthrough

New at this year's KRC Electric Fly was a precision-engineered, belt-driven, miniature, ducted-fan unit for 05 to 15 electric motors. The E-Jet can be configured with twin fans that spread the motor's power over a larger impeller area and enhance efficiency. And *think* of the model jets that could benefit from a twin-fan setup! Because of the dual ball bearings, if disengaged from the belt, the fan will turn in just a slight breeze. On seven cells, a single rotor is turned to more than 32,000rpm with a current draw of 28 to 30 amps. Powered by an Astro Flight 15 cobalt on 14 cells, the twin unit provides 32 ounces of thrust with a current draw of 33 amps. The single costs $55 and the twin, $115. Walter Mitchell, who took more than three years to develop this unit, can be reached at 5320 Ravenna Ave. N.E., Seattle, WA 98105; (206) 524-0977.



STRONG-ARM IT

These new, super-strong, nylon arms from R-Tech are exactly what giant-scale and pattern modelers need. They have long-fiber composite strands molded into them. This virtually eliminates the flexing and twisting that's often associated with the standard plastic arms supplied with radios. This means that *you* get improved control-response accuracy. As well as making the arms very stiff, the composite process also makes them shatter-resistant and structurally stable at high and low temperatures. The way I see it, R-Tech arms are one more form of cheap insurance ag-ainst the ultimate disaster. For more information, contact R-Tech,120 Mountain View Dr., New Milford. CT 06776.

SHIZUOKA SPY SHOT

Here's a photo of the new OK Models Co. EZ Bucker Jungmann 120 taken at the Hobby Show in Shizuoka, Japan. I've closely inspected a prototype of this kit, and I can tell that the Takamatsu family (owners of OK Models) have outdone themselves once again. The level of quality and the fits of the parts are impeccable. These people rewrote the book on ARFs. Though the usual aluminum radial mount for 1.20 to 1.50 4-strokes (or a comparable 2-stroke) is included, the kit also includes predrilled maple mounts specifically for an O.S. 1.60 twin. There's no word yet concerning price or availability, so don't go running to the phone just yet.

DELUXE JR. TELEMASTER

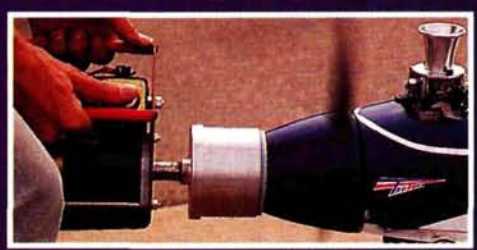
Why another Telemaster? Three very good reasons. It's highly prefabricated, it weighs only 53 ounces, and it costs $117. Hobby Lobby says, "It should take you 10 hours to iron on the covering, install the engine, install the radio and hook up the control linkages. This is one of the highest-quality kits we've ever offered." The 54-inch-wingspan Jr. features: a light epoxy/glass fuselage; an obechi-covered wing that comes joined with fiberglass tape; and an extensive line of accessories, including fuel tank, wheels, pushrods, control horns and a cast-aluminum motor mount. It's designed for .19 to .35 2-stroke engines. Contact Hobby Lobby Intl. Inc., 5614 Franklin Pike Cir., Brentwood, TN 37027; (615) 373-1444.

18-OUNCE LOADING!

Big Block Rotary

It's here! The 2.25ci NSU/Wankel engine from Graupner is now available from Hobby Lobby Intl. This single rotary-piston 4-stroke glow engine weighs in at 64 ounces and puts out 4.5bhp at 10,000rpm without vibration—as long as you carefully balance your props. Its operational range is 2,500 to 11,000rpm on a 20x8 or an 18x10 prop. Included, but not shown here, is a pre-mounted pull-starter. Picture it—*two* of these things—and in a Ziroli B 25. Watch out! For more info, contact Hobby Lobby Intl. Inc., 5614 Franklin Pike Cir., Brentwood, TN 37027; (615) 373-1444.

Monster Motor Starter



No R/C engine can tax the high-torque power of the Monster Motor Starter. The unit uses an automotive battery to start any R/C gas engine—from small to 200cc and larger—including giant-scale racing twins and triples. It was conspicuous at the '93 Madera Races, where the most powerful R/C racing engines in the world had to be started on cue in high-stakes competition. The starter comes in two versions: hand-held ($179.95) and self-contained deluxe with onboard battery ($239.95). Batteries are optional, and it comes in a choice of 3-, 3½- and 4-inch cups. To configure a starter to suit your powerplant, contact James George at Monster Motors by George: (318) 396-7081.

MODEL AIRPLANE NEWS MAGAZINE
CONSTRUCTION

THIS AIRPLANE certainly doesn't require a detailed introduction. It has been written about in all the aviation publications and modeled in almost as many sizes as there are engines to suit them. I first saw the SU-26 in a small three-view that appeared in the January '85 issue of *Air International*. Thinking that it might become a very popular aerobatic model, I started to develop a set of plans for a version with an 82-inch-wingspan. But I never got past the roughing out stage, and I never built the plane. I should have followed my instinct and completed the plans because the model *did* become very popular. The December '87 issue of *Model Aviation* had an excellent article about it.

Nick Ziroli Sr. and his mini Sukhoi. Though it's small, it has big performance!

Micro Air Show

SUKHOI SU-26 Mini

by NICK ZIROLI SR.

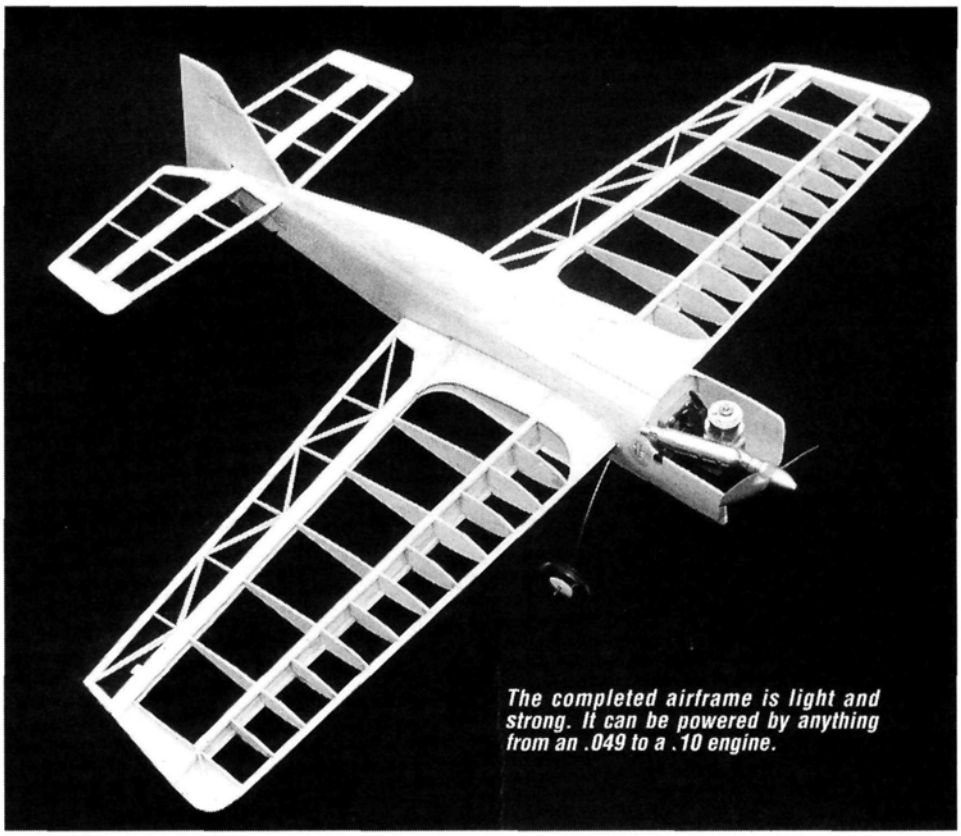
Scale documentation catalogues offer three-views and photos of other versions of the SU-26. Bob Banka's Scale Model Research* catalogue has more than a dozen listings for the SU-26. Alain Proteau, proprietor of Repla-Tech International,* has just released a new catalogue that contains a wealth of information. There are hundreds of side-view drawings of all types of aircraft—well-known and obscure—and six three-views of the SU-26. I highly recommend both catalogues as excellent documentation sources for your next serious scale project.

1/2A POWER

I don't consider this version of the SU-26 a serious scale project. Its design is based on its engine: the Cox* .074 Queen Bee. There's no mistaking this for anything other than a Cox engine, but there *are* some differences between it and other Cox engines. It has a very attractive, effective expansion-chamber muffler. Like most Cox engines, it has a rear reed-valve intake system, and a simple but effective barrel-type carburetor has been fitted to it. The usual glow head has been replaced with a standard short-reach glow plug. No special clips are required to start the engine. It's mounted on side lug mounts, and a drilled plastic mount is also available.

JUST DUCKY

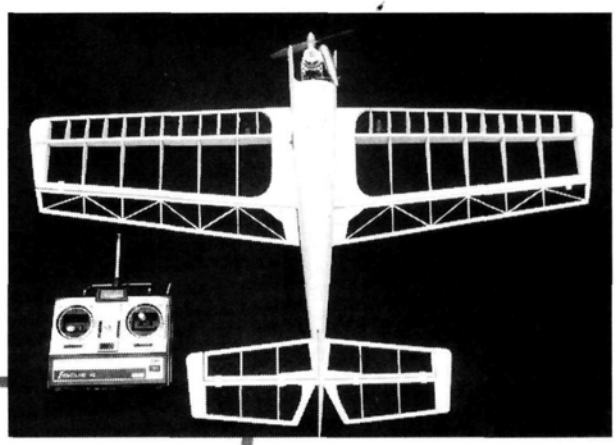
The SU-26 requires a mini airborne radio system, and the Hitec* Focus 4 FM easily meets this requirement. The Micro 535 receiver and four HS80 servos are among the smallest available. This transmitter doesn't have dual-rate switches; in their place are front-panel adjustment controls to set the servo throws. This way, while I'm flying, I can have someone adjust control sensitivity until I'm comfortable with it. When you're satisfied with the setup, the linkages can be readjusted and the servo travel can be dialed back up to take advantage of the full servo travel. This should be done if any of the control-surface movements have been cut way down. I rarely change rates after the first few trim flights, so this works well for me, and there are fewer switches to deal with. Although I use a 4-channel setup, there's no reason why two channels—ailerons and elevator—couldn't do the job. The model would be a couple of ounces lighter, and I think that it would perform well with a Cox TD .049 or an .051.



The completed airframe is light and strong. It can be powered by anything from an .049 to a .10 engine.

One item that I wasn't sure I'd like is the new "Rub'r Duck" antenna. It takes a few flights to get used to the feeling that there's something missing or that you've forgotten to extend the antenna. Flying the small Sukhoi fairly close in most of the time never presented any range problems, but what would happen at a crowded fly-in or contest?

I found out when I put this receiver in my Giant Taube and with the Rub'r Duck-equipped transmitter, flew at the Old Rhinebeck Jamboree at Rhinebeck, NY. This two-day contest has six flight lines in three groups of two. Most of the time, there are six planes in the air. I was flying from one of the center flight lines, and I had to fly close to two other flight lines at opposite ends of the field. Even in this very busy environment, I didn't experience any glitches or control problems. I thought that this was a valid test; it proved to me that this antenna does work as advertised.



Shown here with a Hitec radio, the model has full-house controls. It can be flown satisfactorily with ailerons and elevator only.

Materials

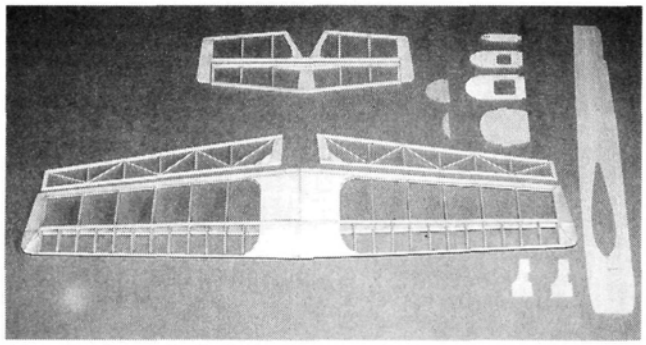
One sheet of 1/16x3x36-inch hard balsa (wing).
Three sheets of 1/16x3x36-inch medium balsa (fuselage top and bottom).
Two sheets of 3/32x3x36-inch medium balsa (fuselage sides and formers).
One sheet of 1/8x3x36-inch medium balsa (cut up for strips, formers and tips).
3/16x3x12-inch piece of medium balsa (ailerons and nose).
Three 3/16-inch-square pieces of medium balsa (leading edge and fuselage stringers).
1/8x6x6-inch piece of plywood (firewall, servo mounts and elevator joiner).
One piece of 1/32-inch-diameter wire (pushrods).
One piece of .078- or .093-inch-diameter wire (landing gear).
As required: hardware, horns, links, wheels, etc.

PHOTOS BY RICH URAVITCH & NICK ZIROLI SR.

CONSTRUCTION

The Sukhoi SU-26 was designed to be a small, relatively simple, aerobatic plane with eye appeal, and it isn't difficult to build. Covering the top of the fuselage is the most difficult task, and that's easier than it looks. For maximum maneuverability, I made all the control surfaces extra-large. Its lightness and large surfaces make the model fly smoothly and perform aerobatics well. The prototype weighed 20 ounces; this was achieved with carefully chosen off-the-shelf balsa.

With the .074 Queen Bee, performance is good. A larger, light .09 or .10 would be outstanding. For those inclined, I think that the Sukhoi would make a very good, small, control-line, stunt model. The moments are almost ideal for this. A bellcrank would have to be linked to the flaps, and elevator would have to be added, but everything else would remain the same. If you're into it, you'll know what to do. Just a thought.



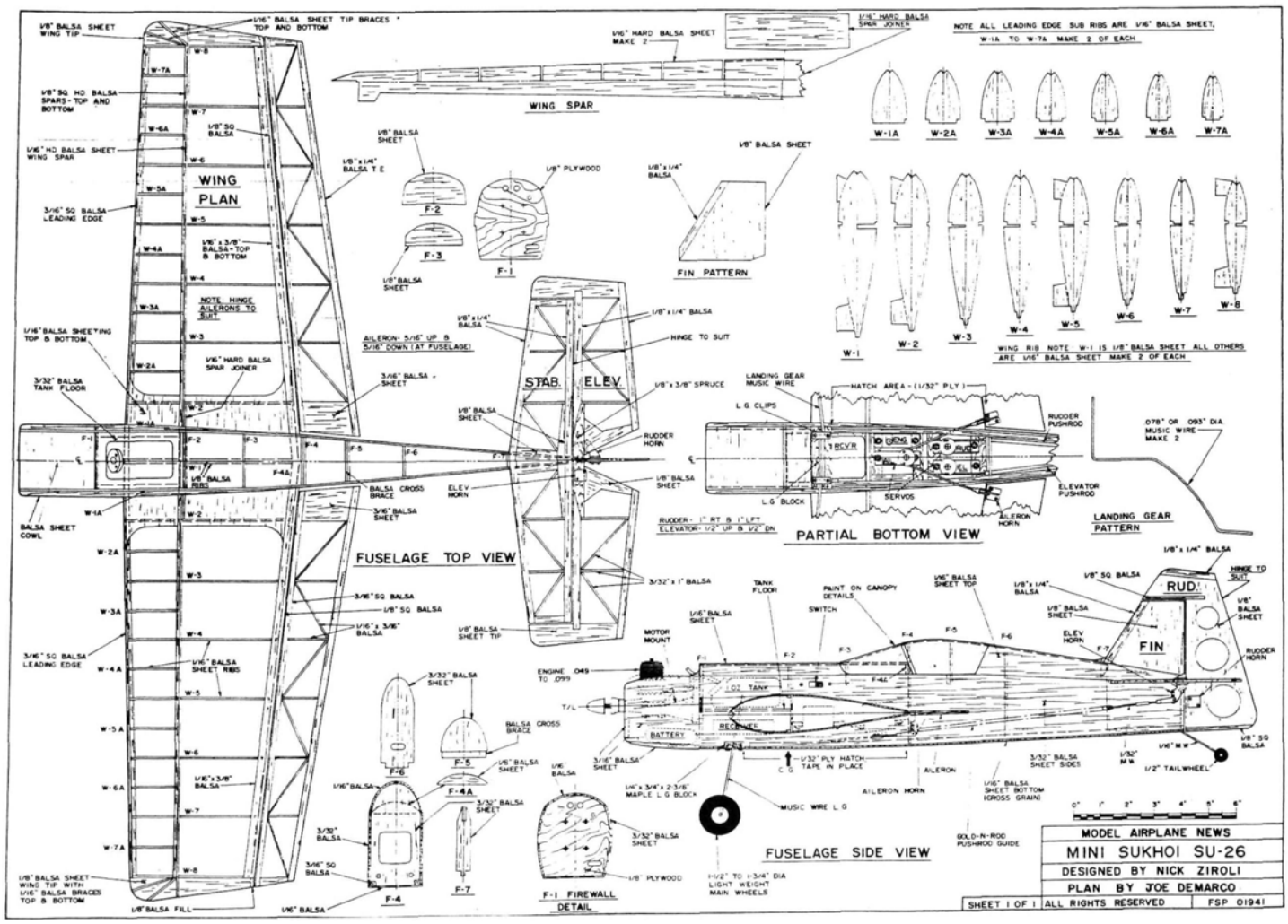
The wing has to be built first because the fuselage is built over it. There's a minimum of parts in the fuselage.

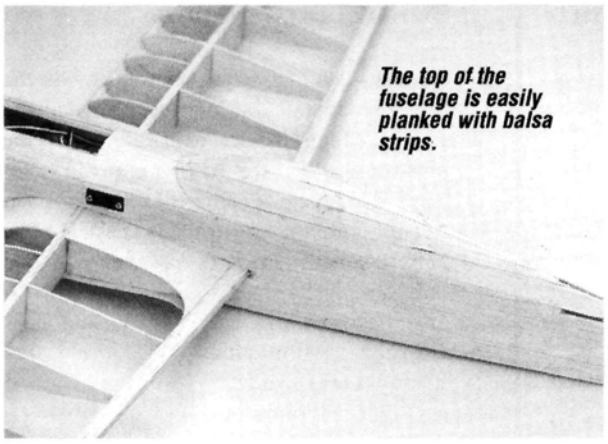
WING

Construction must begin with the wing because the fuselage is built around it. Join the spar halves against a straightedge so that the tip and the center legs are in line. Use hard, 1/16-inch balsa for the joiner. The joiner side is the trailing-edge side of the spar. Working over the plan, attach ribs W-1 and W-8 to the spar. To produce an accurate wing, you must build it on a flat surface. Fit the ribs in place on the spar, but don't glue anything yet.

When I build wings of this type, I prefer to pre-assemble the trailing edges first. If they're made straight, it will almost guarantee a true wing. Using scrap balsa, make eight assembly jigs of the same shape as the aft end of rib W-4; these will act as temporary fixtures—four on each side—to hold the top and bottom open at the correct angle. Pin the wing to a flat surface to dry.

When the finished trailing edges are put into place on the ribs, the leading-edge notches should line up. Glue the ribs to the spar and the trailing edge. Add the 3/16-inch-square leading edge and the 1/8-inch-square top and bottom spars. Fit and glue all the false ribs (W-1A to W-7A) into place. Sheet-cover the center section with 1/16-inch-thick balsa, as shown on the plan.





The top of the fuselage is easily planked with balsa strips.

Add the wingtips, the leading-edge braces and the trailing-edge filler blocks. Using a long sanding block and 180- or 220-grit sandpaper, sand the wing so that the ribs and the joints are smooth and even. Sand the trailing edge flat where former F-4 fits against it.

Cut out the fuselage sides, and glue the 3/16-inch-square balsa along the bottom edge. Cut out the wing opening a little under-size, and join the sides and the wing, but don't glue them yet. With the sides on the wing, glue the firewall into place, and use masking tape to hold it until the glue has dried.

The firewall should have very little right thrust—no more than 1 degree. Add F-4, and glue the tail together. Be sure that the fuselage is square with the wing. Glue in the remaining formers, and glue the fuselage to the wing. Cut away enough of the top leading-edge sheeting between the fuselage sides, and add the fuel-tank floor. Do the same on the bottom for the servos, and install the servo mounts. Add the landing-gear-mount block. Temporarily fasten the engine mount to the firewall with no. 4-40 screws and blind nuts. Put in the pushrod guides and the inner "Gold-N-Rod" tubes. They cross over inside the fuselage. Glue the bottom into place.

TRICKY FUEL TANK

Install the fuel tank and the radio switch in the side of the fuselage. Cover the nose from the firewall back to F-4 with 1/16-inch balsa. You can make a hatch for access to the fuel tank, if desired. I don't use a conventional fuel tank in my model; instead, I use a simple balloon tank like the ones used on the Jim Walker "Firebaby" 1/2A control-line models, which we enjoyed flying more than 40 years ago. It isn't a pressure tank or a pen-bladder tank—just a balloon that, in its deflated state, has enough volume for the required amount of fuel.

Insert a piece of rigid plastic tubing—such as Ace's* EZ Flex Tubing—into a 9-inch-diameter deflated balloon, and cut off the excess just outside the neck. Slide 1/2A fuel line over this tube so that it passes through the neck, and tie the neck closed using heavy thread or string. There should be no vents. Fill the tank through the feed line using a squeeze bulb, but before you attach the bulb, squeeze it a little so that when it's released, it will collapse the balloon tank and remove all the air. Hold the plane and the bulb nose-down, and backfill the tank. I've found that, with this tank, the engine runs well whether the tank is full or down to the last drop.

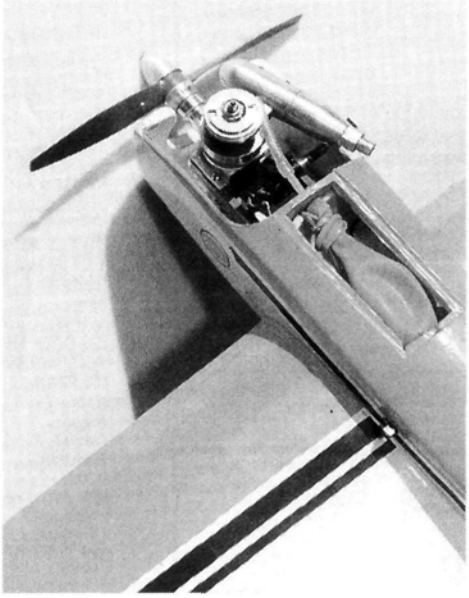
FINAL ASSEMBLY

Build the tail surfaces and the ailerons over the plan. The tail is made of 1/8-inch-thick balsa. The ailerons are 3/16 inch thick with a 1/8x1/4-inch trailing edge. Build the ailerons flat on your building board, and using a sanding block, taper them from 3/16 inch at the leading edge to 1/8 inch at the trailing edge. Cut the fin and the rudder out of 1/8-inch-thick balsa. Sand a radius on the appropriate edges of the ailerons and tail surfaces.

I prefer to cut the hinge slots before I cover the surfaces—especially if transparent covering is to be used—because balsa slivers always seem to end up inside the covering. I also think that it's best to cover or finish stabilizers—and, in many cases, fins—before you install them. In this case, both should be covered with an iron-on film before they're installed.

Carefully install the stabilizer and the fin so that they're square with the fuselage from the top and aligned with the wing from the front. Cover the aft end of the fuselage with 1/16x1/2-inch strips of balsa. Dampen them, if necessary, and then bend them over the top of the canopy. Sand the fuselage in preparation for covering. Bend the landing gear to shape, and trial-fit it to the fuselage. Don't install it permanently until after your model has been covered. I always brush on a coat of Coverite's* Balsarite before I apply any iron-on material. Cover the plane and the control surfaces with whichever iron-on film you prefer. There are many good films to choose from, and they come in a variety of colors. After you've covered your model, hinge all the control surfaces with sheet-plastic hinges, such as those offered by Sig* or Ace.

To make room for the receiver, cut away



Above: with the hatch removed, you can see my balloon-type fuel system. It provides consistent engine runs.

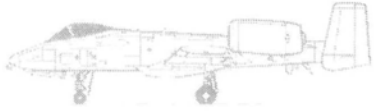
Right: though the wing has a lot of open area, it's quite strong when covered.

the wing leading-edge sheeting inside the fuselage. Install the landing gear and the wheels. Mount the servos, and hook up the pushrods. Place the receiver in the fuselage, and isolate it using thin foam rubber. Let the antenna trail out of the tail. The bottom cover is made of 1/32-inch plywood or a thin plastic sheet and held in place with tape. Although it may seem crude, it's light and simple, and it doesn't have to be removed often. For the flight-pack battery, wrap a 250 to 270mAh pack in wide plastic packing tape to seal it against fuel, and epoxy it to the bottom of the cowl. Again, it's crude but functional. To complete the model, mount the engine and the fuel tank.

A hatch in the fuselage's belly allows radio access. Notice that the aileron pushrods exit the fuselage at the sides.

Make sure that the balance point is where it's shown on the plan. The prototype didn't require any additional weight. Start with the control-surface travel that's called for, and adjust it to suit after flying. Takeoffs from the ground aren't a problem—even from grass, if it isn't too long. All our flying has been ROG. The Sukhoi is a highly maneuverable model, and with the Queen Bee, it can be flown from an extremely small area. With a larger, more powerful engine, it will use up a lot more sky. I hope you like this one. I've enjoyed the change of pace from my giant-scale models.

**Here are the addresses of the companies mentioned in this article:*
Scale Model Research, *3114 Yukon Ave., Costa Mesa, CA 92626.*
Repla-Tech Intl., *P.O. Box 461000, Cole Branch, Los Angeles, CA 90046-1000.*
Cox Hobbies, *350 W. Rincon St., Corona, CA 91720.*
Hitec/RCD, *10729 Wheatlands Ave., Ste. C, Santee, CA 92071.*
Ace R/C Inc., *116 W. 19th St., Box 511C, Higginsville, MO 64037.*
Coverite, *420 Babylon Rd., Horsham, PA 19044.*
Sig Mfg. Co., *401 S. Front St., Montezuma, IA 50171.*■



PILOT PROJECTS

A LOOK AT WHAT OUR READERS ARE DOING

SEND IN YOUR SNAPSHOTS

Model Airplane News is your magazine and, as always, we encourage reader participation. In "Pilot Projects," we feature pictures from you—our readers. Both color slides and color prints are acceptable.

All photos used in this section will be eligible for a grand prize of $500, to be awarded at the end of 1994. The winner will be chosen from all entries published, so get a photo or two, plus a brief description, and send them in!

Send those pictures to: Pilot Projects, Model Airplane News, 251 Danbury Rd., Wilton, CT 06897.

MARVELOUS MARQUART CHARGER

This ¼-scale Marquart Charger bipe was built from a Walt Mouch kit by Raymond Niemier of Madrid, IA. The 17-pound model is powered with a Quadra 42 gas engine. It has a wingspan of 73 inches, and it's controlled with a Futaba 6-channel radio. The finish is fluorescent pink and black Ultracote and Keller paint, and the smoke trails are created with a B&B smoke system and a pump.

TEXAS TRIPLANE

This incredible Fokker DR-1 triplane is the work of Jim Cassidy of El Paso, TX. Scratch-built from his own plans, Jim's Fokker includes a handmade aluminum cowl, steel cable trailing edges, pulley and cable control activation (no servos in the wings), independent bungee wheel suspension, steel ferrule and spruce wing struts, and a 24-inch-diameter redwood and walnut laminated display prop. The ¼-scale model weighs 14.8 pounds, and it's powered by an Enya 120R 4-stroke engine. Finishing touches include handmade brass shells and bullets fed into the Williams Bros. machine gun through aluminum bullet feeds.

WET AND DRY STORCH

Pete Williams of Gardnerville, NV, scratch-built this stand-off scale Fiesler Storch FI-156 from German Antique Model Association plans. The 3.4-pound model was originally designed for free flight, and Pete has flown it with an FAI 05 electric motor on 6 cells (the dry version) and an O.S. .20 4-stroke engine (wet fuel version). The wing area is 520 square inches; the wingspan is 63 inches; and a NASA-drooped leading edge is used on the outer 12 inches of each wing panel. The wing loading on the electric version is 15.92 ounces per square foot, and the glow-powered version has a wing loading of only 14.77. The model has great slow-speed habits, and it can climb at extremely steep angles without stalling.

PILOT PROJECTS

COOL KOMET

This 1/6-scale Messerschmitt Me-163 rocket interceptor is the work of Terry Jenkins of Phoenix, AZ. Built from a Bob Holman semi-kit, the plane has a 61-inch wingspan, and it's powered by a Webra .61 with a tuned pipe. The wings are foam-core with balsa skins and a fiberglass finish. All-up weight is 6 pounds, and it's finished with Perfect Paint. The model has a fixed center main wheel, a steerable tail wheel and two non-scale wingtip outrigger wheels for improved ground handling. (The full-size plane has a two-wheel dolly that falls away after takeoff.)

SUPER SOPWITH

Larry Mills of Harrisburg, AR, spent 400 hours building this great-looking 1/3-scale Sopwith Pup from a Balsa USA kit. Powered by a Zenoah G-62 engine turning a Zinger 22x6-10 prop, the 30-pound model has a Bennett smoke system. The radio is a JR Max 6, and the finish is Super Coverite with Formula-U paint.

LAKE BEAST

Dale Thome of Frankfort, IL, built this model from a Swenson Specialties kit and powers it with an O.S. .61 2-stroke engine. Made of foam, ply and balsa, the model took only 23 hours to complete. The Beast is anything but a beast when it comes to flight. Dale says its landings and takeoffs are rock-steady, while loops and rolls are a thing of beauty.

FINE FOKKER

Kay Mastie of Alpena, MI, built this beautiful Fokker D-VII from a Sterling kit. Power comes from a K&B .65 sportster engine turning a 13x6 prop. The Solartex finish has a hand-painted lozenge pattern and a clear coat of satin polyurethane. All-up flying weight is 9 pounds.

COBRA IN DISGUISE

Adam DeLeon of Ellsworth Air Force Base, SD, scratch-built this Russian helicopter gunship fuselage and mounted it on his O.S. .50-powered GMP Cobra. The fuselage is built mostly of balsa with very little plywood reinforcement, and it comes apart in four pieces. The finish is Testors plastic model paint with a fuelproof satin clear coat. All-up weight is 12 pounds with a Century VII radio and a gyro.

MODEL AIRPLANE NEWS MAGAZINE
FIELD & BENCH REVIEW

AEROCRAFT Apache

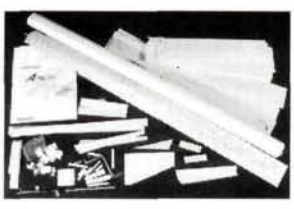
by CLYDE GEIST

PHOTOS BY CLYDE GEIST

Electric sport model with performance and style

IF YOU'VE BEEN in R/C for a while, you probably have a plane that you call "old reliable." My 3-year-old old reliable is an original design that I call the "Flashback," and it's a veteran of 482 great flights. I'm so happy with this plane that, when it makes its 500th flight, I'm going to throw a party for it! But you know how it is: no matter how comfortable you are with your model, you always have eyes for another. You think you might even do better with something else.

The Aerocraft* Apache caught my attention in a magazine ad. And after seeing it at the WRAM show and talking with Aerocraft's designer Craig Wagner about its features, my loyalty to the Flashback was over. I bought an Apache.

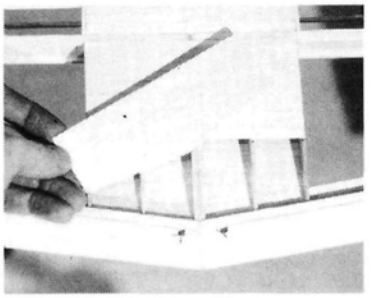


The Apache kit is complete and includes high-quality hardware; a vacuum-formed cowl and clear canopy; and full-size, blue-line plans.

While the model occupied a place in my workshop called the "back burner," a couple of my friends, Bill and Carl, also bought Apaches. In fact, both were almost ready to be covered when *Model Airplane News* editor-in-chief Tom Atwood asked me if I would construct and review mine for this article.

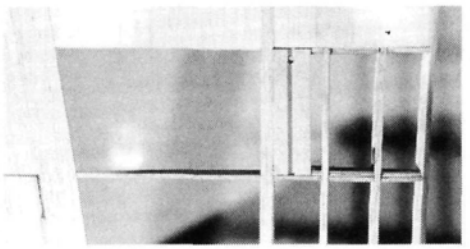
Having built a .035-powered Aerocraft

Snapper, I was no stranger to their products. The Snapper shows an original approach to making a lively combat/sport machine. In contrast, the Apache could best be described as a more typical-looking sport model that has style and is uniquely designed for performance.



The wing's center section is sheeted, and the opening for the aileron servo is then cut out. Notice the vertical-grain spar webbing between each rib.

The box says it's for electric or glow power with 2-, 3-, or 4-channel control. Few, if any, of Aerocraft's competitors' offerings can fly like this one with its double-tapered, high-lift, turbulated, transitioning airfoil with built-in washout. This results in a broad-range flight envelope. Consider having removable landing gear, the best battery and motor cooling available, a breakaway battery box (in case of a crash) and a mid-wing vertical balance point. Then consider getting it in a kit that can be built quickly and that has the right stuff for almost any motor/battery combination—geared or direct drive, cobalt or ferrite motors—and you'll know why I bought the versatile Apache. It can be framed up and ready to cover in five or six hours.



The optional maple landing-gear block has been installed in the wing. Doublers strengthen the ribs.

KIT CONTENTS

In the box, I found prefabricated parts, including two plywood and six balsa die-cut sheets and dozens of cut or shaped parts and stick material. There were also more than 50 pieces of high-grade hardware, including CA wick hinges; virgin-nylon clevises; plated screws; lock collars; etc. Sturdy pre-bent landing gear; a heavy, vacuum-formed cowl; and a clear canopy are standard equipment. Rolled, detailed, blue-line, full-size plans and a step-by-step manual guide you through construction, regardless of your skill level. No exotic materials are included or required (phew!).

CONSTRUCTION

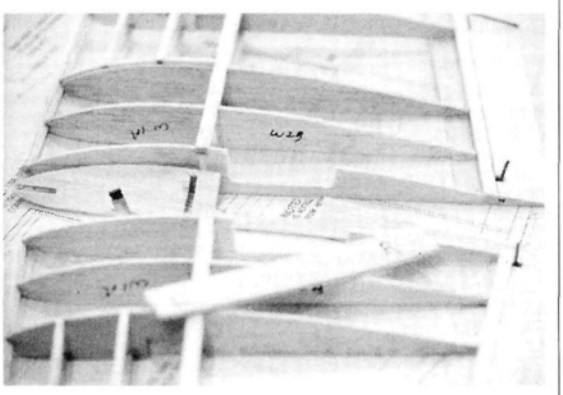
This plane was my friend Bill's first solo effort at building a balsa model from a kit. The instructions led him right through its construction without a hitch, but he *did* need advice about motors and related equipment. Bill's die-cut plywood hadn't been stamped all the way through, so it took him extra time to remove each piece; the die-cutting in my kit was fine. I used Pacer* Zap and Zap-a-Dap-a-Goo throughout.

Following the instructions step by step, I began by labeling each part on the die-cut sheets. Be aware that some illustrations show the *back* of the sheet.

The wing has a typical rib-and-spar (main and turbulator) construction, and the ribs are all different sizes. They were die-cut neatly, but I *did* have to cut the shear web out of the stock 3-inch-wide sheet as well as the wing's center-section sheeting. The completed wing halves are joined upside-down because the wing top is flat; the bottom tapers up to form a sort of dihedral, and this made my trial-fitting and final gluing much easier. Aileron stock is miter-cut full length to the plan and slotted for the quick-style hinges. I completed my wing in two hours. If you choose to use the included landing-gear brackets, you should glue two maple blocks to ribs 3 and 4.

The stabilizer and the rudder are made of 3/16x3/8-inch balsa stock that's miter-cut and glued into place over the protected plan. After I had cut the slots for the hinges, I shaped the machine-cut rudder and the stabilizer halves and assembled them using the plywood joiner.

The fuselage looks oval, but the sides are actually die-cut slabs. Half-round bulkhead caps are attached to the top for the "look." I began with the bulkhead sub-assemblies; some are die-cut, and some are stick-built over the plans. After joining these to the fuselage sides, it's time to trial-fit the wing and add the 3/16-inch dowel front mounts and the screwed-down rear mounts. The scoop (battery box) is likewise built in place over the inverted wing.



The wing halves are ready to be joined. Notice the cutout for the aileron servo and the torque tube aileron linkage.

Attaching a clear canopy is always a pain, so Bill left his off. But I like Carl's method; I used metal aviation shears to rough-cut my canopy, and then sanded it using 120-grit sandpaper. I glued the bottom to a piece of black cardboard (shaped on the fuselage), then I trimmed it and attached it to the fuselage. The sturdy cowl is held in place with no. 2 mounting screws and 1/4-inch pine stock glued to the firewall sides. The prop shaft and cooling holes were cut with an X-Acto knife and shaped with a Dremel* sanding drum. Final sanding is where I always spare no effort; I spent about an hour on this using a large block with 120-grit sandpaper.

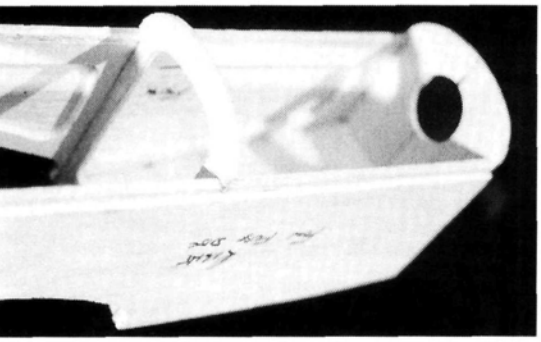
SPECIFICATIONS

Model name: Apache
Type: Sport pattern electric
Manufacturer: Aerocraft
List price: $59.95
Wingspan: 44 inches
Wing area: 340 sq. in.
Weight: 38 oz. (47 oz., as built)
Wing loading: 15.8 oz per sq. ft.
Airfoil: Eppler 205
Washout built into wing?: Yes
Length: 39 in.
Motor used: Kyosho AP 36
Prop used: Graupner 6x6
No. of channels req'd: 3 or 4 (speed controller, elevator, aileron; rudder optional)
Speed controller used: Tekin TSC410K
Wing construction: Balsa frame, double-taper, turbulated
Fuselage construction: Built-up balsa and ply

Features: plywood and balsa die-cut parts; many pre-shaped and cut parts; stick material; high-grade hardware items, including CA wick hinges, plastic clevises, screws, and lock collars; pre-bent wire landing gear; vacuum-formed cowl and clear canopy; rolled, blue-line, full-size plans; and construction manual.

Hits
- Breakaway battery box that minimizes crash damage.
- Super cooling of motor and battery.
- Flies well.
- Can be built quickly.

Misses
- In one kit (of three), die-cutting was poor.
- Landing gear and rudder increase advertised weight by 10 ounces.

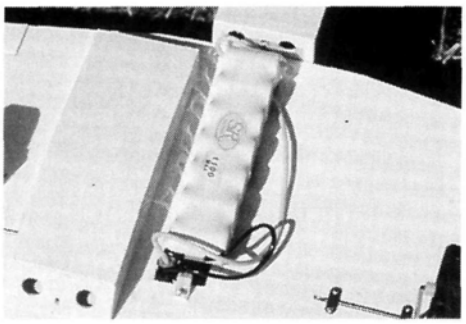


Here are the forward fuselage formers. Notice the inner fuselage doublers and the square stock that caps the fuselage sides.

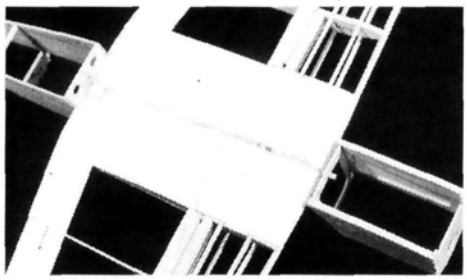
POWERING THE APACHE

The recommended Astro* Cobalt direct-drive .05 power package is an excellent choice, but I thought that the Apache's aerodynamics might benefit from a geared unit. Why? A larger prop with a higher pitch (a 10x10 APC*) reduces flat-out speed by about 20 percent, but it offers vertical pulling power that's far superior and reduces power consumption by 40 percent. This aerobatic model is capable of safe slow-speed maneuvers (desirable in electric aerobatics), so the geared motor unit is my first choice. I might add that the landing gear won't produce significant drag at these slower speeds, and takeoffs require less runway.

But this tame, efficient power system won't make full use of the Apache's streamlined structure or its super-cooled motor and battery compartments. For the prototype, the manufacturer used a hot Astro FAI .05, direct-drive, 7-cell motor, which I happened to have on hand. I could fly it streamlined without the landing gear. Which one should I build? Bill can build the geared version, Carl will build the Cobalt direct-driven one, and I'll build an economical ferrite version.



The scoop has been removed to show the battery installation. When in place, the scoop makes a handy grip for hand-launching the model.



The wing is secured to the fuselage with an alignment dowel in the leading edge and a hold-down bolt at the trailing edge.

Readers who are new to electrics and who are contemplating a power system for the Apache may wish to consider this. If you use a lighter motor (I mounted motors using Sonic Tronics mounts), your Apache may be slightly tail-heavy, and you should be remedy this by adding nose weight.

I've used the following speed controllers in the Apache: an Astro 205, a Flight Tec*, a Tekin* 410K, a Horak* SPC40 and a Jomar* SM-4, but you could use any unit that's capable of handling at least 40 amps of continuous current.

FLIGHT PERFORMANCE

With a Kyosho AP 36 electric motor, a Graupner* 6x6 prop, seven 1500mAh cells and a Tekin 410K speed controller, the Apache's motor reached about 12,200rpm. Flight times were about 4½ minutes, and the calculated speed was approximately 65mph. After 30 flights, my model is none the worse for wear. Carl's suffered some scoop damage. In a crash, the motor will "give" in its mount, and the battery scoop will break loose; this greatly minimizes damage to the plane.*

• Takeoff and landing

Without the landing gear, you can easily hand-launch the Apache, using the scoop for a grip. Ground takeoffs with the landing gear attached and the operational rudder installed are easier than with most tail-draggers. The wide main gear provides sure tracking, and instant tail lift makes a tail wheel unnecessary.

• High-speed performance

The direct-drive versions of the Apache are only somewhat faster than the geared ones. This would indicate a relatively higher induced drag at higher speeds compared with that of planes with thinner airfoils. I consider flying the Apache at very high speeds a waste of power. No trim changes are required at different throttle settings.

• Low-speed performance

This is where this airfoil pays its way. All controls respond right down to stall speed. At quarter power, half up-elevator, it will stand still in 10-knot wind. Battery "ballast" and control response contribute to crosswind stability. Stalls occur straight ahead at such slow speeds that powered recovery is almost immediate.

• Aerobatics

With heavy electric components, the Apache will never outperform lighter, fuel-powered sport models, but it should outdo most electrics. It does snaps, rolls, loops, hammerheads and most novice patterns. Inverted flight requires slight down-elevator for straight level flight. Dead-stick: flying with the nose kept slightly down, you wouldn't know the difference. Dead-stick stalls require about 20 feet of nose-down altitude loss to recover.

POWER PACKAGES

MOTOR/GEAR	CELLS/BATTERY (mAh)	AMPS/WATTS	PROP	RPM	TOP SPEED†	RUN TIME	COMMENTS
DIRECT DRIVE							
Graupner Ultra 800 FAI	7/Sanyo 1700 SCRC	36/252 40/280	Graupner race 6.5x6.5 7x7	14,000 13,000	75 mph	2.5 min.	Remove landing gear; heavy motor balances with heavy battery.
Graupner Speed 600	7/SR 1500	25/175	Graupner 6x6	12,000	60	3.5	SELFI pylon legal; super-low cost.
Great Planes* GoldFire	7/SR 1500	25/175	Graupner 6x6	12,000	60	3.5	SELFI pylon legal; super-low cost.
Kyosho AP36L	7/SR 1500	22/140	Graupner 6x6	12,200	65	4.5	Efficient ball-bearing motor; economical.
Trinity* Air Supply	6/SR-1100	18/108	Graupner 6x6	10,400	45	3.5	Light; economical; easy to set up.
Astro FAI 05	7/SR-1100	34/240	Graupner 7x7	13,400	80	2.5	Best choice for speed.
GEAR DRIVE							
Kyosho 16-turn monster truck/2.5:1††	7/SR-1100	30/210	Kyosho 9x8	6,500	52	2	Good vertical patterns; use landing gear or folding prop.
Astro 05G/2.21:1	7/SR-1100	22/155	APC 10x10	6,500	55	3	Super vertical; high quality.
Astro 15G/2.21:1	12/Sanyo 600†††	17/270	Zinger*11x6	8,000	50	2	Small cells limit duration.
Astro FAI 15/2.21:1	10/SR-1100	30/300	APC 10x10	7,500	70	2	Fastest gear version.
Astro 035/2.21:1	6/SR-1100	20/120	Zinger 10x6	5,500	40	3	Light; efficient.

†Top speed (without landing gear) is calculated as rpm/1,000 multiplied by propeller pitch minus a drag factor. ††Master Airscrew* †††½ sub-C

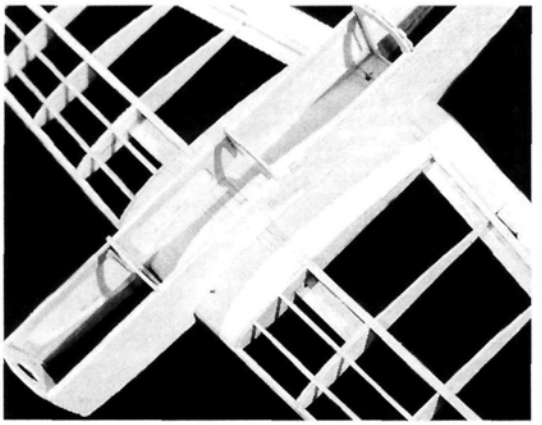
I've flown the system with a battery-eliminator circuit (BEC) and with onboard receiver batteries. (I recommend SR 300mAh or Sanyo or Radio Shack 270mAh batteries.) Note also that the SR-1100 cells indicated in the "Power Packages" chart are two-thirds-length sub-C cells, which are slightly lighter than standard sub-C cells. (For choices and layouts, see the sidebar.)

FINAL ASSEMBLY

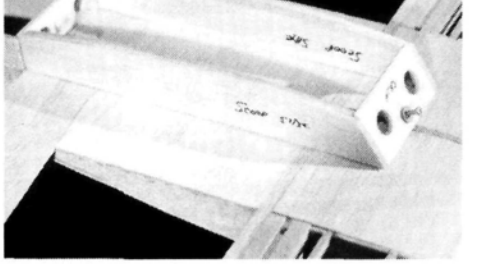
For control, I use a Futaba* transmitter with an RCD* receiver and Futaba S-133 miniature servos. The covering is white MonoKote*, and the graphics for the test

Here, a Graupner Ultra 800 FAI has been installed with the use of a Sonic Tronics motor mount (recommended by the manufacturer). The mount will "give" in a crash.

model are from Aerocraft. The manufacturer recommends a Sonic Tronics* adjustable motor mount. I used this and two others to test the model, and the Sonic Tronics mount worked satisfactorily. For a less expensive alternative to a commercially available mount, install two ¼-inch-square hardwood rails to act as a cradle mount. Place your motor on the firewall at its proper thrust and center-line location, and draw a circle to represent its outside diameter. The two hardwood rail mounts go through the firewall and are glued to it and former F2 to form any desired downthrust. The rails should be canted inward slightly and should lie flush with the outer case of the motor. The motor can then be secured with plastic tie-wraps.



Here, the wing and the fuselage have been temporarily joined to check their alignment and fit. Notice that the fuselage sides are made of two interlocking side sheets. The wing's leading edge has two turbulator spars.

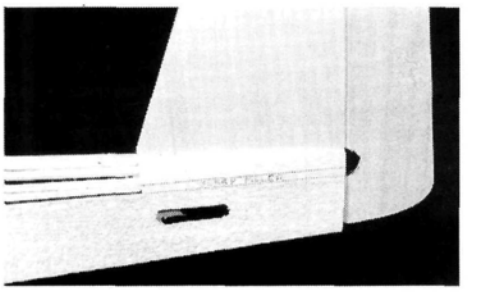


The P-51-like belly scoop is used to house the drive batteries and is designed to break away easily in a crash. This minimizes structural damage and makes repairs easier.

CONCLUSION

Aerocraft's William Schaeffer noticed that this model looks like a P-51. The early test prototype P-51 was also called the Apache. Like its multipurpose ancestor, the Apache can be powered in several ways; it's almost difficult to choose one.

I enjoy every flight with the Apache; in fact, after only 450 more flights, I'll throw a party for it. It won't take long.



When it's time to install and shape the tail-filler blocks, install a scrap filler in the horizontal stab slot. When you've finished, remove the scrap, and slide the stab into place.

**Here are the addresses of the companies mentioned in this article:*

Aerocraft Model Mfg. Co., *P.O. Box 553, East Northport, NY 11731.*

Pacer Technology & Research, *9420 Santa Anita Ave., Rancho Cucamonga, CA 91730.*

Dremel, *4915 21st St., Racine, WI 53406.*

Astro Flight Inc., *13311 Beach Ave., Marina Del Rey, CA 90292.*

APC Props/Landing Products, *P.O. Box 938, Knights Landing, CA 95645.*

Flight Tec, *21 Juniper Way, Hamilton, NJ 08619.*

Jiri Horak, *2480 Dunwin Dr., Mississagua, Ontario, Canada, L5L 1J9.*

Jomar Products, *3440 Riverhills Dr., Cincinnati, OH 45244.*

Futaba Corp. of America, *4 Studebaker, Irvine, CA 92718.*

Hitec RCD, *10729 Wheatlands Ave., Ste. C, Santee, CA 92071.*

MonoKote; *distributed by Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61826.*

Sonic Tronics Inc., *7865 Mill Rd., Elkins Park, PA 19117.*

Kyosho/Great Planes Model Distributors, *P.O. Box 9021, Champaign, IL 61826.*

Graupner; *distributed by Hobby Lobby Intl., 5614 Franklin Pike Cir., Brentwood, TN 37027.*

Tekin Electronics, *940 Calle Negocio, # 140, San Clemente, CA 92673.*

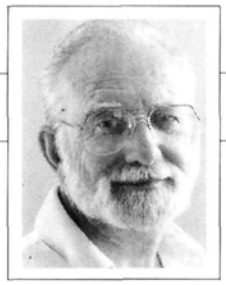
Great Planes Model Distributors, *see address above.*

Trinity Products Inc., *1901 E. Linden Ave., # 8, Linden, NJ 07036.*

Master Airscrew; *distributed by Windsor Propeller Co., 3219 Monier Cir., Rancho Cordova, CA 95742.*

Zinger; *distributed J&Z Products, 25029 S. Vermont Ave., Harbor City, CA 90710.* ■

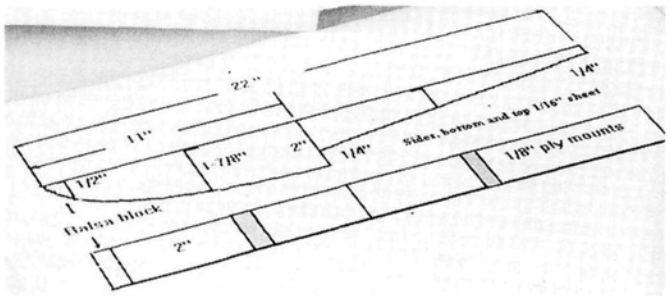
HOW TO:



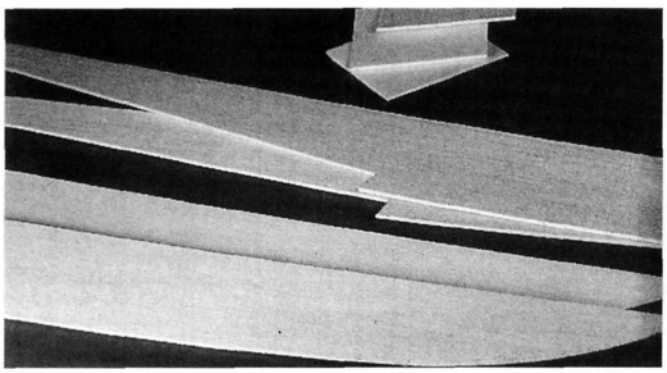
RANDY RANDOLPH

MAKE 1/2A FLOATS

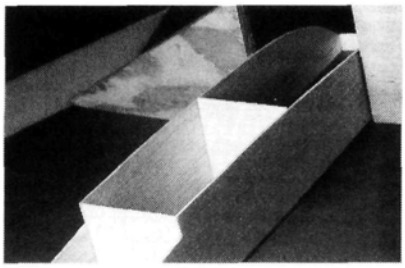
THERE ARE A NUMBER of excellent float kits available for .40 to .60 airplanes, and even larger ones, but there are very few for the smaller models. The floats described here are for models in the .049 to .074 power range that weigh no more than 26 ounces. They're based on a design by long-time modeler and sailor Bill Caldwell, and they'll give a good account of themselves on water and snow.



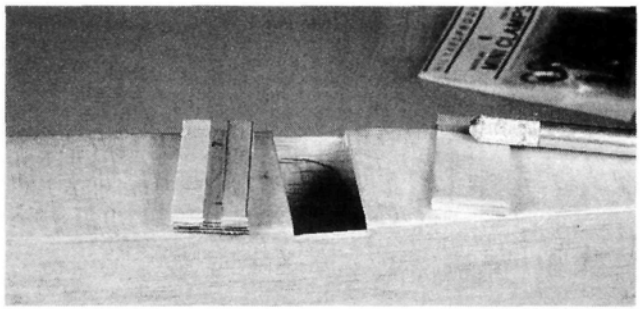
1 *As you can see, the plans are simple. Start by drawing a straight, 22-inch line. If you don't feel confident in your ability to draw the sweeping curve from the step to the bow freehand, use a French curve. The floats are a uniform 2 inches wide, so you don't need a top view.*



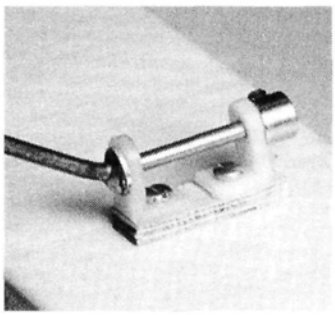
2 *Cut the four float sides out of 1/16-inch sheet balsa, using your plan as a template. The bulkheads are also made of 1/16-inch sheet balsa. Double the bulkheads' thickness at the step and the transom. This will allow the bottom sheeting to have good solid footing on the rear of the step. Make two 2x1-inch plywood mounting anchors.*



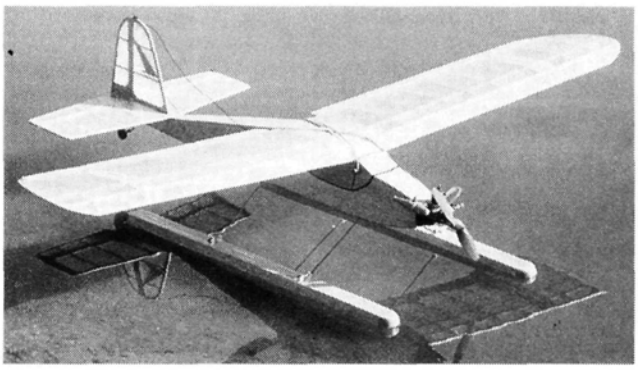
3 *With their tops flat on the workbench, assemble the floats upside-down. Glue the bulkheads to both sides, then turn the float over and add the top sheeting. Measure from the airplane's balance point to the vertical plane of its landing-gear's axle position. Now, measure the same distance forward from the step on the float; at that point, glue one plywood mounting anchor to the inside of the top sheeting. Glue the aft ply anchor about halfway between the step and the back of the float. Mark the positions of both anchors on the outside of the float, and complete the bottom sheeting. Sand the completed floats, and cover them with MonoKote**



4 *You'll need a rear landing-gear leg; it's easiest to use a torsion gear and to install the mount just aft of the wing. The fuselage mounting plate is simply a piece of 1/8x1 1/2-inch plywood that will fit between the fuselage sides. Two more pieces of 1/8-inch plywood form a channel for two, 3/32-inch, music-wire landing-gear legs. Bend the legs to match the rear mounting locations on the floats.*



5 *The actual float mounts are plastic angle brackets that are available at most hobby shops. Anchor them with small wood screws that go through the top sheeting and into the plywood below. The landing-gear legs and the aft gear legs are slipped through the brackets and held with wheel collars.*



6 *Mount the floats so the airplane's center line is parallel, or at a slightly positive angle, to their tops. If the step is correctly positioned at the airplane's balance point, directional control on the water should be good with only the air rudder. To taxi, hold back-stick, and then add a little forward-stick to get the airplane up on the step for takeoff. There's no spreader bar, so hand-launching is still easy. Have fun!*

Above: his colorful 1964 vintage Aircoupe was built by W Price of Vacaville, CA. The 90-inch-wingspan model is powered by an O.S. 1.60 twin-cylinder engine and weigh 20 pounds. Note the shock-absorbing landing gear.

Left: event organizer and Pilot's Choice award winner Eva Wolfe of Meadow Vista, CA, built this impressive B-17 Super Fortress heavy bomber from a Westcraft kit. It's powered by four Saito .90 twin-cylinder engines, has a wingspan of 121 inches and weighs 49 pounds.

2nd Annual Four-Stroke Scale Squadron EXPO

BUT DOES IT SOUND REAL?

by JERRY NELSON

IN THEORY, on Father's Day, dads can do anything they want—with an approved family pass. The only *logical* thing to do is to go to a model contest. Since the day is supposed to be one of relaxation, what better contest to attend than the Second Annual Informal Four-Stroke Scale Squadron Exposition in Northern California.

SOUNDS GOOD

Event organizer, Evan Wolfe and many assistants from the Davis/Woodland and Sacramento, CA, areas again held another laid-back scale competition.

With the Exposition, all the engines must be 4-strokes and they fly in a specified way—scale-like—for the judges. The objects of this meet are that the models give an overall impression of being prototypes and that the participants have fun.

Static-only entries did not require documentation and were judged from a distance of 5 feet. Pilots who flew were judged on how realistically their planes performed. Scale-like air speeds and maneuvers typical of the full-size aircraft were paramount as was the sound of the powerplants.

Credit must be given to Evan; he has expended a lot of effort in evaluating model aircraft engine sound. He judges according to this standard: an engine's sound should be judged by cadence and pitch and how closely it resembles the sound of the full-scale aircraft depicted.

Left: Reno Clark of Sacramento, CA, flew this F4U5N Navy Corsair with an impressive YS 1.20 engine turning a 14x7 prop. The 9-pound, 14-ounce model can reach speeds of up to 140mph while burning 60-percent-nitro fuel.

Above: just about to touch down, this beautiful, 14.5-pound, all-silver Ryan STA was built from a Golden Age Models kit by Fred Reese of Rockland, CA. It's ¼ scale, has a 90-inch wingspan and is powered by an O.S. 1.20. It won Best Civilian award; full cockpit detail, working seat-belt buckles, rivets and rib-stitching details set it apart from the rest.

Center: last year's champion Forrest Edwards flew, but didn't compete with, his very popular Polikarpov PO2 biplane. The 30-pound, ¼ -scale model has a 9.5-foot wingspan and 3,500 square inches of wing area. It's powered by Forrest's own scratch-built, 5-cylinder, 5.7ci radial engine turning a 24x16 prop at 5,000rpm. The engine runs on anything from Coleman gas-lamp fuel to high-octane Avgas.

Above: powered by an O.S. .91, this 10-pound, ⅓-scale P-47D Thunderbolt was built from a Top Flight kit by Jeff Weiss of Sacramento, CA. It has a 61-inch wingspan, an on-board glow driver and sequencing gear doors.

Below: a pair of Proctor Nieuport 28s: in front—Richard Moore's; behind—Bob Vernum's Most Realistic Flight award winner.

Above: Ken Safer of Fremont, CA, won Best Mechanical Achievement with his unusual Messerschmitt Me-109F. The ⅛-scale model has a 62-inch wingspan and is powered by an O.S. engine. It has functional flaps and dive brakes and is painted with Poly S paints.

There were four judges, all of whom pilot full-scale aircraft. I was among the judges. This year, we did not operate in teams of two; instead, we simply observed the aircraft during the two days of flying. We watched from the pit areas, the flight line, the food-service area, the vendors' displays, or wherever. We met at noon on Sunday and, as a group, decided which aircraft were superior in each category. It couldn't have been easier; and we had a ball looking real official-like! Our meeting went well; the winners were properly judged with a high degree of professionalism.

ENGINES

The weather was super hot—106 degrees—and most engines were cowled and glow-plug operated. Many used 4-stroke fuel with 15 percent nitro. O.S. engines were the most numerous, followed by Saitos and Enyas. The high temperatures didn't seem to affect the engines. Several were operated on ignition systems using glow fuel.

Most contestants agreed that high-nitro fuel is used to help an engine idle reliably and not for additional power. An exception to this was Reno Clark's YS120-powered Top Flite Corsair. He uses 15-percent-nitro fuel for sport flying and 60 percent for warbird pylon racing! The YS on 60 percent turns 12,000rpm with a 14.5x14 prop, resulting in an air speed of 140mph. Several glow-fuel engines were operated on ignition systems; engines running on gas-based fuel seemed to have very sensitive throttle-mixture settings.

Also on display were two radials: a Robart 7-cylinder and an Edwards 5-cylinder. Forrest Edwards took all the prizes at last year's Exposition with his fabulous Polikarpov PO-2 biplane powered with a 4-stroke radial he designed and built.

Owing to its outstanding achievement last year, the PO-2 wasn't officially entered in this year's competition, but it did fly several times. A new addition to its engine was a centrifugally operated spark-advance system that eliminated the need for a throttle-coupled mechanical-advance/retard system. Advance timing is at 32 degrees, and retard timing is at 20 degrees. I asked Forrest which fuel is best for his engine, and he said it doesn't make too much difference. He has successfully used everything from Colman gas-lantern fuel to 140-octane aviation fuel. It's interesting that the Valvoline 20-50 racing oil used with the Edwards radial is not mixed with the fuel but is supplied by a dry sump in the engine.

SCALE FLIGHTS

I flew my Saito 300T twin-powered aluminum AL-1 several times. With a C&H ignition system and a home fuel blend recommended by C&H (3 quarts of methanol, 1 quart of 15 percent glow fuel and 10 ounces of Klotz oil). Turning a Zinger 18x12 prop, the Saito runs at about 6,500rpm and can pull the aircraft through climbing vertical 8s.

Dick Henning of Proctor Kits demonstrated the Seidel 7-cylinder in his new ¼-scale Fokker E-III Eindeckker. The Seidel 7 turned a Clark Airfoil laminated 24x13 propeller at 4,100rpm and idled very slowly at about 700rpm. Fuel for the Seidel is straight methanol with 7 percent Klotz oil. The E-III wasn't quite ready for flying at the Exposition, but it will certainly be of masters'-scale competition quality. Of interest is the way the model rolls by warping its wings.

Credit must also be given to the organizer, Evan Wolfe, for his two fine aircraft: a 26-pound Byron F-6F Hellcat powered very well by a Saito 5-cylinder radial (this has been flying for several years) and a fabulous Westcraft B-17 powered by four Saito .90 twin-cylinder engines. The Saito fits the Hellcat's cowl perfectly and looks very authentic. It sounds great in the air and has a glow driver that's used when the throttle goes to idle.

The B-17, which Evan had just completed, had flown only a few times before the meet, but it flew so well that you'd never guess that it was a brand-new airplane. Controlled by an Airtronics radio and powered by four Saito .90 twins using C&H ignition systems, the B-17 has a 121-inch wingspan and weighs 49 pounds. It took to the air at noon each day; the engines started easily, the model taxied out and then took off just like the real thing. The homemade retracts worked just perfectly, and it made high- and low-speed passes during its rather lengthy flights. All of its engines were running as it taxied back after each flight. Special credit must be given to crew chief Boyd De France (this airplane really needs a crew chief) and to Rodger Grotheer, who did the flying.

In closing, special thanks must be given to the folks at Airtronics and Futaba, who donated radio systems, and to the many other manufacturers who also donated merchandise awards. ■

WINNERS

Award	Pilot	Model
Most Realistic Flight	Robert Vernum	Nieuport 28
Best Static	Robert Vernum	Albatross DVA
Best Mechanical Achievement	Ken Safter	Me-109F
Best Military	Jay Price	Hawker Sea Fury
Best Civilian	Fred Reese	Ryan STA
Most Realistic Sound		
Single Engine*	Art Cummings	Evans VP-1 Home-built
Multi Engine**	Evan Wolfe	B-17 Flying Fortress
Pilots' Choice	Evan Wolfe	B-17

*O.S. 160 twin; ** four Saito .90 twins

Making Sound Judgments

Judging scale sound involves a variety of things, but the two most important are cadence and the pitch of the engine's exhaust.

■ **CADENCE** denotes the number of firing impulses per minute.

A 1-cylinder 4-stroke at 8,000rpm emits 4,000 exhaust notes per minute.

A 12-cylinder P-51 at 3,000rpm (maximum takeoff rpm) emits 18,000 notes per minute. No matter how throaty the note, the single-cylinder engine will probably sound better in a Cub trying to imitate four cylinders at 2,300rpm than a 12-cylinder Merlin.

A 5-cylinder radial turning at 7,500rpm would be about right to simulate the cadence of a full-size 14- or 8-cylinder radial at 2,800rpm.

Generally, the models should compromise their cadence (to make it slightly slower than scale) because their pitch will be higher and humans tend to equate a higher pitch sound with higher speeds.

■ **PITCH** refers to the frequency of the exhaust note.

This is a difficult area for modelers who are attempting to replicate the sound of big engines. Generally, a long exhaust pipe will lower the effective pitch of the exhaust and enhance its realism. Use your best judgment when assessing the realism of your exhaust pitch. Hearing it is a large part of the sensation of "experiencing" the performance of a full-size aircraft. Close your eyes momentarily and listen to your model's sound to compare it to the full-scale aircraft it represents.

Four-stroke engines are known for their quietness; even when a 4-stroke is emitting the same number of decibels as a 2-stroke, it will seem much quieter. Typically, a 4-stroke's operating rpm is much lower than a 2-stroke's, so prop noise is less.

HOW TO

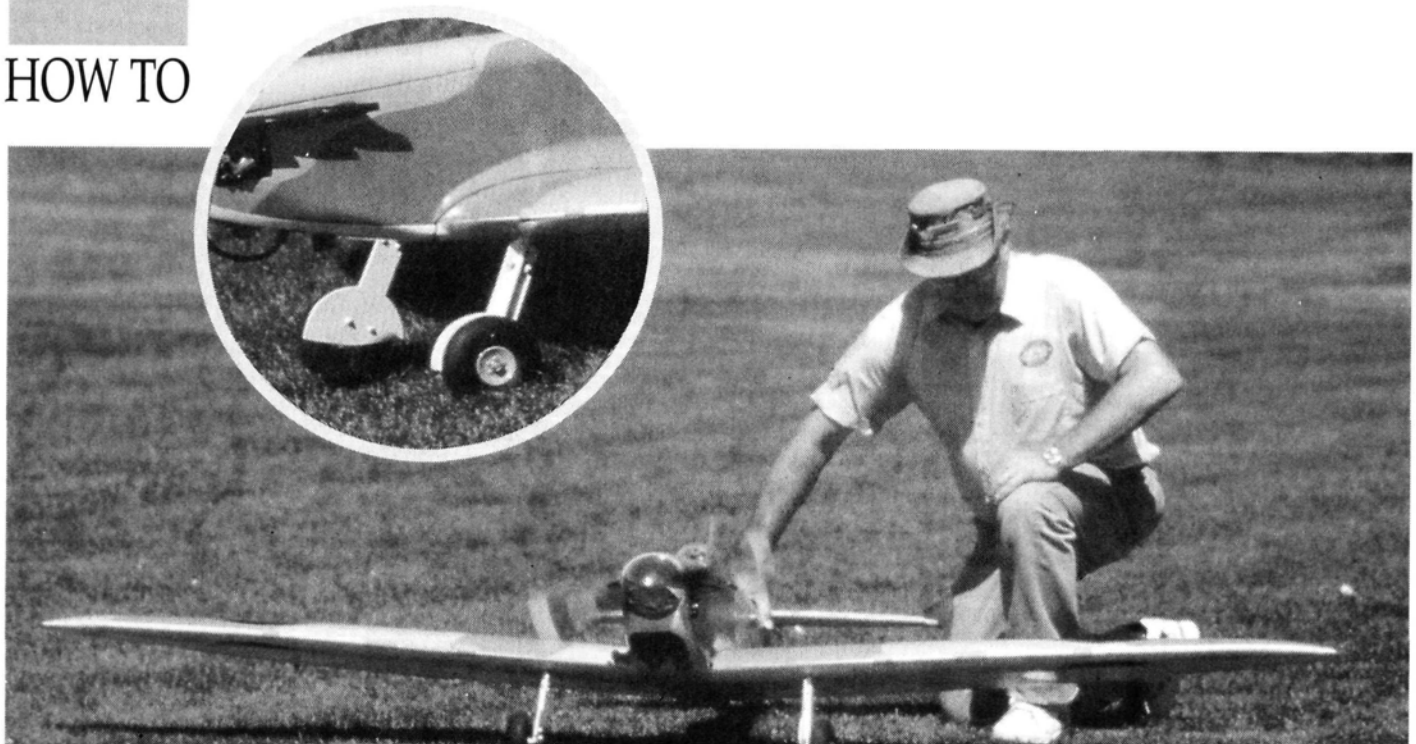


Photo by Gerry Yorrish

Ken's scratch-built, Quadra 42-powered Spitfire makes use of the shock-absorbing landing gear that he designed. Super-smooth takeoffs and landings are just two of the benefits.

How To Make Shock-Absorbing Landing Gear

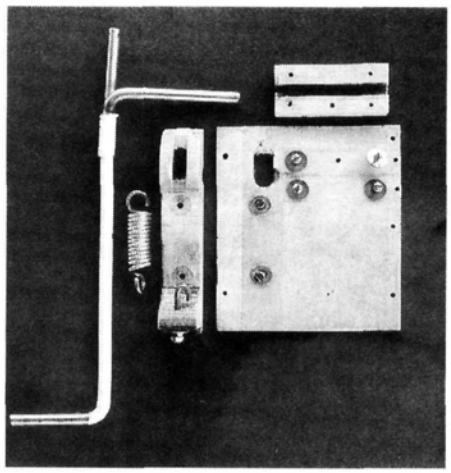
Smooth out the bumps and improve ground handling

by KEN GILMOUR

WOULD YOU LIKE a set of fixed, shock-absorbing landing gear that allows your scale airplane to make butter-smooth touchdowns? The set I describe here is fairly easy to build, and—a bonus!—it's sure to be a conversation piece at the flying field.

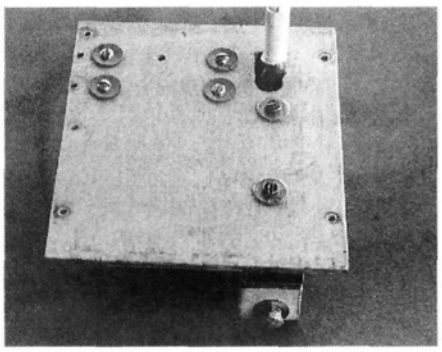
I designed the gear for my scratch-built, 19-pound, Quadra 42-powered Spitfire. It does a fine job of absorbing the shock when a rough landing would otherwise stress and damage the gear attachment points.

In the size shown, the gear will handle a 20-pound airplane quite nicely, and you can scale it up or down to suit your particular model. It's a super design for .60 and larger models.

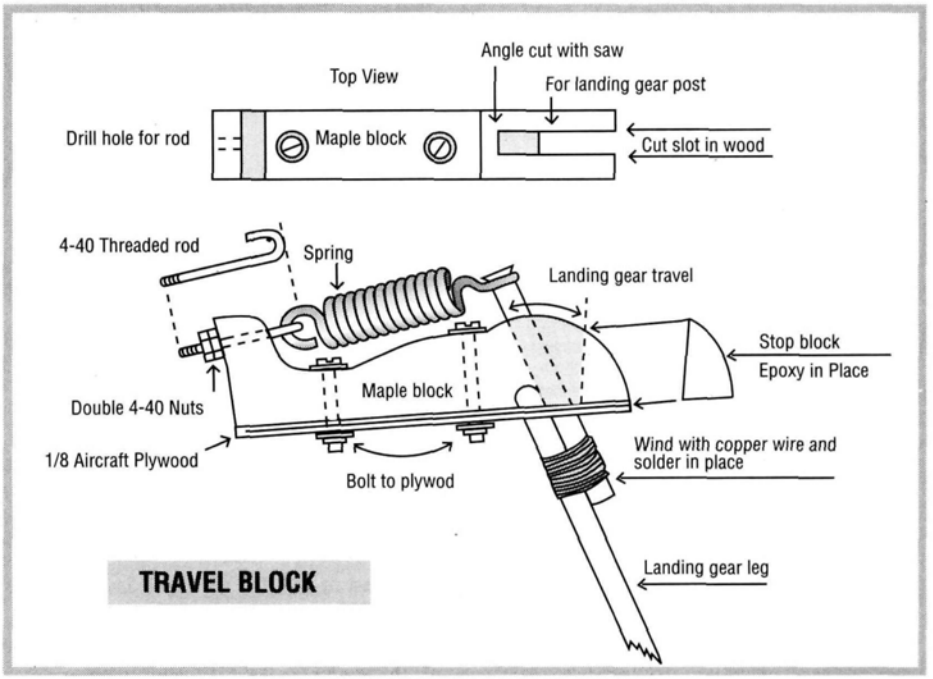


Photos by George Thompson

The parts of the landing-gear system are few and easy to make. The blocks are made of hard maple.



The view from underneath the unit. When the gear system is installed in your wing, a balsa hatch cover or block will improve your plane's appearance by filling the recess in the wing's underside.



Mount it in front of or behind the wing's main spar. It all comes down to the size of the mounting blocks and the strength of the spring used. Scratchbuilders will find it easy to piece together a design for models of almost any size.

MAKING THE SYSTEM

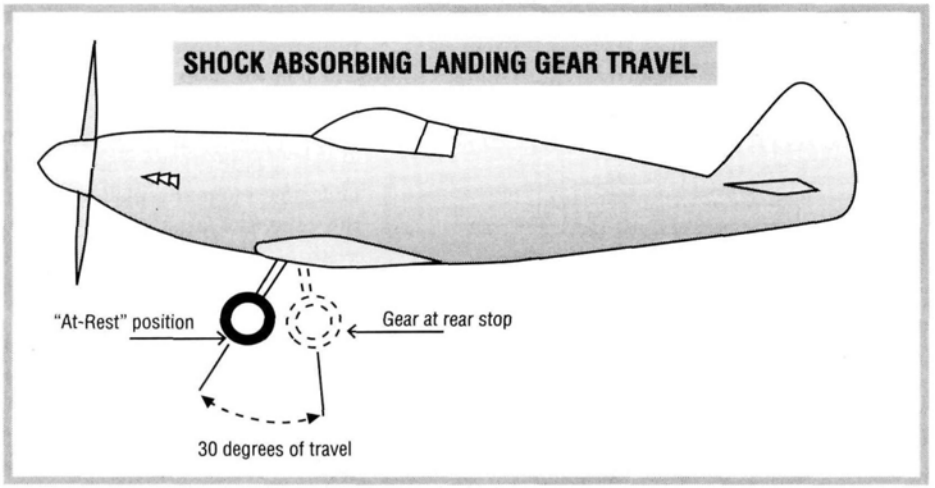
The long, 3/4-inch-wide maple travel block that's used to anchor the spring has a 1/4-inch-wide angled slot cut into its front with a band saw. This angle determines the gear's at-rest position. An angled stop block is put into this slot to serve as the mechanical stop for the landing gear's rearward travel. (I use about 30 degrees of travel.)

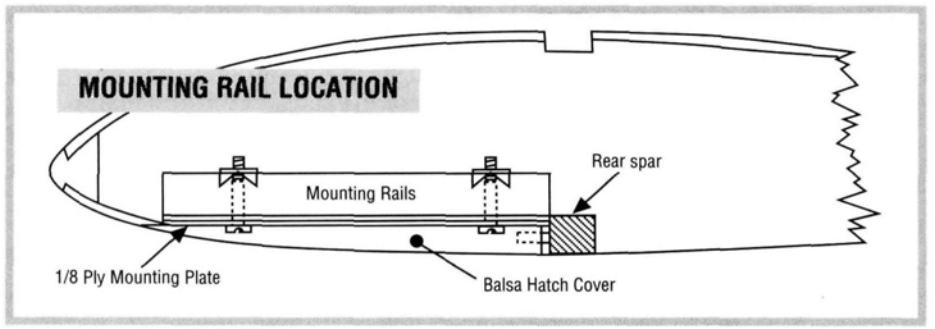
The maple hold-down block holds down the horizontal pivot arm. It has a 3/16-inch-square groove cut into one face. I used a round file to shape the groove into a "U"; it holds the wire firmly in place, but it allows the gear leg to pivot easily. During a crash, the first blocks I made split down the middle, so I've replaced them with thicker—5/8 inch—maple.

Make the landing-gear legs and the short vertical post that's soldered to the upper part of the leg out of music wire. Notice that the post is soldered to the leg so that it's in front of it and at 90 degrees to the horizontal pivot arm.

I use 50:50 solder and copper wire to hold the post for the spring on the landing-gear wire. It holds the post securely—no side-to-side movement. Using a Dremel* Moto-tool, I cut a groove around the top of the post to hold the spring in place. Be very careful, and *always wear eye protection* when you cut music wire or use a Dremel tool.

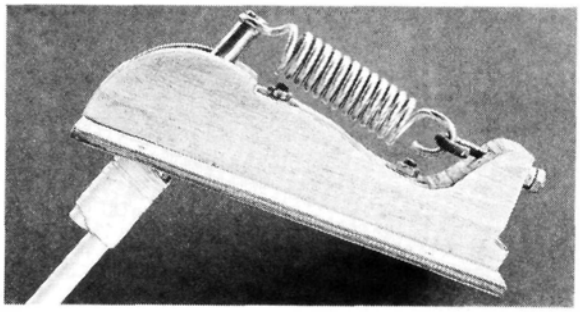
At the other end, the spring is hooked on a J-bolt—a 4-40 with nuts. This J-bolt runs through the rear of the travel block (see drawing). The spring's tension can be varied by adjusting the length of the J-bolt. With a little redesigning, some sort of setscrew adjustment can be installed to fine-tune the gear's "at-rest" and stop angles.





YOU'LL NEED...

- **5/8-inch-thick maple** for the blocks that hold the landing gear in place. Use *only* hard maple; pine and other woods won't last as well.
- **1/8-inch aircraft-grade plywood** to make the mounting plate, which is bolted to the ribs.
- **Two 3/8-inch-square maple mounting rails** to hold the 1/8-inch plywood in place (they're epoxied to the inside of the ribs).
- **1/8-inch plywood doublers** to strengthen the wing ribs.
- **A no. 49 spring** from a tool supply store.
- **3/16-inch diameter music wire** for the landing gear and the post to which the spring is attached.
- **Assorted hardware:** solder, copper wire, blind nuts, screws, bolts and washers—all readily available. To spread the loads, put washers under all the screw heads.



The heart of the system is this spring. One end is attached to the top of the post that holds the gear; the other end is held by a J-bolt that can be used to adjust spring tension.

INSTALLATION

Cut the mounting plate to size, and mark where the landing-gear leg will go through it. Position the plate between two appropriate ribs in the wing half. Cut a slot that's centered at this location and is long enough to allow the gear leg to pivot fully.

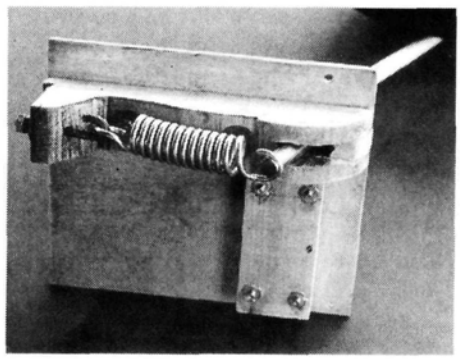
Epoxy 1/8-inch-thick plywood doublers to the inner faces of the ribs; then epoxy the two 3/8-inch-square mounting rails into position. When the epoxy has dried, put the plate under the mounting rails, and at each corner of the plate, drill holes that also go into the rails. Install blind nuts in the top of the rails and screw the plate to them.

Using your model's plans as a guide, calculate what the angle of the travel block's slot should be and then cut it. Also measure the distance from the axle to the center of the slot in the block, and bend the landing-gear-leg wires to shape.

On my gear, the vertical post is 2 3/4 inches long. Assemble the blocks, spring, J-bolt and landing-gear leg, as shown, and slip the leg into the slot in the mounting plate.

When you're satisfied with the axle's position, drill though the hold-down block and the travel block and the plate, and then epoxy and bolt the parts together. Next, coat everything with epoxy to seal the wood.

With the left and right wing halves installed, check to ensure that the wheel axles are in line and have slight toe-in. Finally, cut the stop block, trial-fit it in the front travel-block slot, and check the operation of the gear. When you're satisfied with the amount of travel you have, epoxy the stop block into the slot. (To help strengthen it, you can drill a hole through the travel and stop blocks and bolt the stop block into place as well as gluing it.)



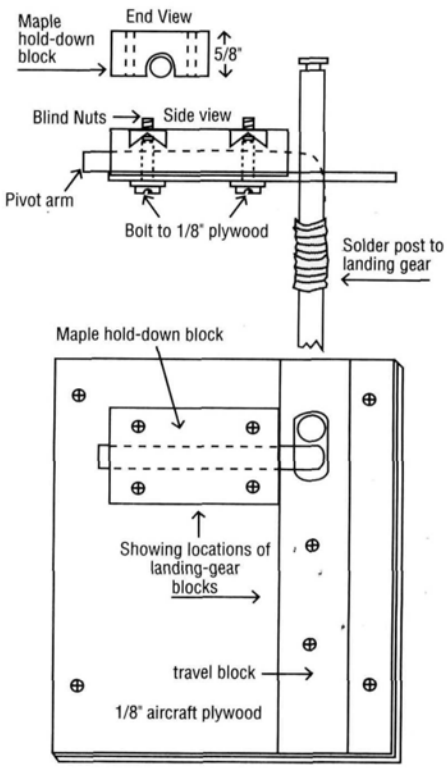
This top view shows the layout of the blocks and the spring in the finished unit. The mounting plate is 1/8-inch aircraft plywood.

To improve your model's looks, install a balsa hatch cover or block under the mounting plate to clean up the recessed area above the gear. With a tab-and-screw arrangement, the cover can be removed and replaced quickly.

That's it! With the gear installed and working in your model, you'll see how smooth your takeoffs and landings can be. And there are other benefits: if you do make a *hard* landing, the plates will break away from the wing, so there will be less damage than there would have been if you had installed your gear on a traditional hardwood grooved block. Repairs will be easier to make, and the wear and tear on your airframe will be greatly reduced.

**Here's the address of the company mentioned in this article:*
***Dremel,** 4915 21st St. Racine, WI 53406.* ■

DETAIL OF HORIZONTAL PIVOT ARM



MODEL AIRPLANE NEWS
FIELD & BENCH REVIEW

Scale soaring at its best...

PHOTOS BY SAL IASILLI

by SAL IASILLI

ROBBE ASH 26-E

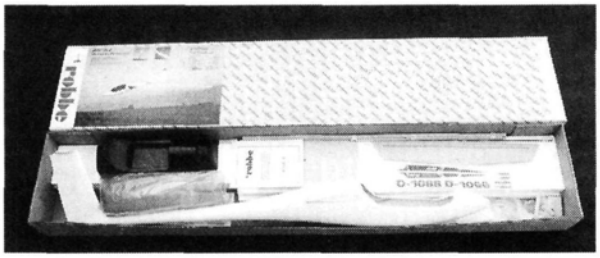
THE SUPER ORCHID ASH 26-E—the newest design from Alexander Schleicher Sailplanes of Germany—is a 17-meter, single-seater, high-performance glider. When the full-scale design goes into full production, it will feature an engine for self-launching. (The engine will retract into the upper fuselage during thermalling.)

The fuselage dimensions and wing geometry of Robbe's* ¼-scale model ASH 26-E are exactly to scale. To increase stability, the tailplane has been slightly enlarged from true scale. A special Quabeck airfoil provides the model with a wide speed range which, in turn, can be used for thermalling or slope soaring. A retractable electric motor mount will be available from Robbe Model Sport in early spring 1994. This will enable the model to self-launch off the ground.

THE KIT

The kit contains a white, seamless, epoxy fuselage that requires no painting. The fuselage also features wing fairings, cockpit flanges, incidence angles molded into the wing-root fair-

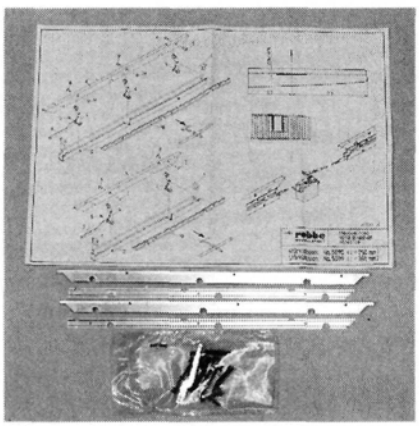
When the design goes into full production, it will feature an engine for self-launching. (The engine will retract into the upper fuselage during thermalling.)



Everything is neatly packed in the kit's huge box.

ings and factory-installed control horns at the base of the fin. The black, vacuum-molded cockpit has a clear, large, vacuum-molded canopy. The interior fittings are made of die-cut plywood, and the rudder and elevator control-rod tubes are epoxied into the fuselage.

The wings are obechi-sheeted machine-cut foam-cores, and the double-deck air-brake housings are already mounted in the wings. The integral wing-joiner blade sockets are factory-fitted and bonded into the spars to absorb bending loads. The ailerons and aileron servo wells are cut, as are the cable tunnels for the aileron servo and flap servo. The wing-joiner rods are angled for correct dihedral. The obechi leading edges are cut and installed on the main wing panels, and the extremely convex wing-tips are of ABS molded plastic. The tailplane is also obechi-sheeted foam-core, and the rudder is solid balsa.



The spoiler assembly has its own instruction sheet with drawings.

Accessories include double-deck spoilers; flat, wing-support steel blades and wing joiners with an integral clamp retainer, and a spring-loaded canopy-locking device.

The R/C hardware items include pushrods, pushrod ends, threaded couplers, clevises, horns and clear-plastic hinge tape for the flying surfaces. There's also a decal sheet, a detailed instruction booklet (in several languages) and plans with drawings that show optional R/C installations.

PREPARING THE WING PANELS

The main panels, leading edge and trailing edge of the obechi-sheeted wing panels must be sanded. It's important that the leading-edge profile be kept exactly as shown in the instructions to achieve optimum flight performance. Because some modelers may not want to fit flaps, only the ailerons come already cut out of the main wing panels. If you're thinking of using flaps, now is the time to decide. I chose to use the flaps because all I do is thermal flying.

The plans show where the flaps are to be cut free of the main panels. Once you've cut the ailerons and flaps, sand the ailerons' and flaps' leading-edge angles to the angles shown on the plans. Sand 2mm off the main wing panels' trailing edges and 2mm off the flaps' and ailerons' leading edges to compensate for the 2mm-thick lining strips.

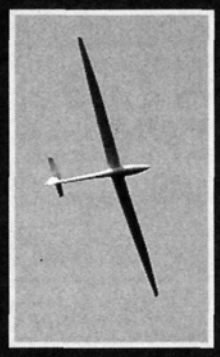
Use aliphatic-resin glue to stick the 2mm-thick lining strips to the wing panels, flaps and ailerons. To prevent them from warping while the glue for the lining strips cures, it's very important that the flaps and ailerons be pinned down to a flat surface. The instruction manual recommends that you cut the flaps' servo wells out of the wings' top surfaces. The aileron servo wells have already been cut out of the wing's top. I felt that the plane would have a more pleasing appearance if the servo hatches were on the bottom surface of the wings, so I filled in the pre-cut aileron servo wells and cut access holes to the servos on the lower surfaces of the wings (this is what's usually done). *[Editor's note: Robbe placed flaps and aileron pushrods at the top of the wing for scale appearance. The original had them placed on top.]*

FITTING THE WINGS TO THE FUSELAGE

Rectangular slots for the wing-joiner tubes are molded into the fuselage root fairings to ensure correct positioning. Use a drill and a file to complete the cutting and shaping of these slots. When the slots are ready, assemble the wing-joiner tubes, following the separate instruction sheet that's provided, then fit this assembly to the fuselage and align it with the slots.

Next, fit the steel joiner blades into each

SPECIFICATIONS



Model name: ASH 26-E
Manufacturer: Robbe Model Sport
Type: High-performance scale sailplane
List price: $849.95 (plus S&H)
Wingspan: 177.3 in.
Wing area: 1,213 sq. in.
Weight: 9 lb.
Wing loading: 17 oz. per sq. ft.
Airfoil type: Quabeck
Washout built into wing?: No
Length: 70.33 in.
No. of channels req'd: 4 to 8
Radio used: Airtronics Vision
Wing construction: Obechi-sheeted foam-cores
Kit construction: Epoxy fuselage, sheeted-foam wing and tailplane
Optional accessories used: Flaps, spoilers, aero-tow release

Features: a seamless, epoxy fuselage finished in white gelcoat; pre-sheeted foam wings and tailplane; vacuum-formed canopy and canopy tray; complete hardware package; Mylar decals; instruction manual and detailed plans.

Hits

- **Exceptionally well-made, seamless, epoxy fuselage that requires no filling or painting.**
- **Pre-sheeted wings and tailplane cut assembly time to a minimum.**
- **Excellent flight performance.**

Misses

- **The rivet heads had to be filed because the air-brake housings installed in the wings were a little too snug to allow the spoilers to work smoothly.**
- **The plywood die-cut parts hadn't been cut through completely, so I had to use a Dremel saw.**

wing panel, then trial-fit the panels to the fuselage. While this is assembled, tack the joiner blade housing to the fuselage with CA. Next, remove the blades and wings from the wing-joiner assembly, and use a mixture of epoxy and filler to bond the wing-joiner assembly to the fuselage.

Epoxy the steel wing blades into each wing panel along with the rear alignment pin. Once the epoxy has cured, drill the proper holes in the plywood root ribs to accommodate the servo extension leads and air-brake wire. Then, epoxy the root ribs to each wing panel.

Author Sal Iasilli proudly displays the ASH-26E, which has a wingspan that's 2½ times his height.

FLIGHT PERFORMANCE

Made mostly of composites, this sailplane is durable and well-built; it should last through many seasons of continuous flying.

• Takeoff and landing

Winch-launching a sailplane of this size requires two people and a strong winch. On the launch, the ASH-26E has a nice climb-out. There's a slight drop in the tail when the plane Is released, but when the right air speed is achieved, it quickly corrects itself. (This is a common characteristic of T-tails when they're winch-launched.) Zoom release can give you good altitude with surprisingly little wing flexing. Although winch launching is acceptable, to get the optimum performance from this sailplane, aero-towing is the way to go. ROG takeoffs are safer and, with an aircraft of this size , you're airborne within 25 feet—with no bad habits. It flies as smoothly and as safely as a trainer. With double-deck spoilers, landings are precise; I've also used 90-degree flaps, which can shorten the landing even more, but requires full-travel down-trim elevator compensation, which I have programmed into my radio.

• Low-speed performance

In the middle of a winch launch, I experienced a line breakage before my sailplane had reached optimum speed. With the nose at an angle of approximately 60 degrees, the ASH virtually did a tail slide before falling forward and diving more than 100 feet before recovering. This was a good example of stall behavior at its best. In normal flying, I've never experienced any bad stall habits. Even when the plane was thermalling in the tightest turns at a very low speed, it was as steady as a rock, mainly because of its markedly upturned wingtips.

• High-speed performance

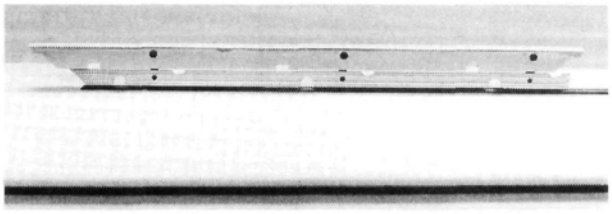
Although this airfoil is highly undercambered, you can achieve high speeds by reflexing the ailerons and flaps approximately 3 degrees—a great asset when trying to leave a sink area in a hurry.

• Aerobatics

Aerobatics have been limited to graceful loops and stall turns. I've flown the ASH in close to zero wind and in wind of up to 25mph, but I never winch-launch it in winds of more than 10mph. Aero-towing is the only way to fly in high winds.

INSTALLING THE SERVOS IN THE WING PANELS

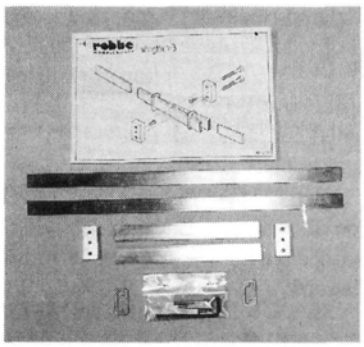
The use of metal-gear servos is strongly recommended for both the aileron servo and the flap servo. I chose the Airtronics* 141 high-torque, ball-bearing microservos, which worked out well. The wing panels come with installed plastic tubes that route the servo leads through the wing panels to the wing roots. I used 1/16-inch-thick plywood servo hatch covers to mount both the flap and aileron servos on the bottom of each wing panel.



The double-blade air brakes are very effective.

COMPLETING THE WING PANELS

The alignment of the vacuum-molded wingtips is crucial to flight performance, so follow the instructions closely. Before you fit them into each wing panel's factory-installed housing, assemble the double-deck spoilers as shown on the separate instruction sheet. The housing had been installed a little too snugly, so I had to file down the heads of the rivets that connect the armature to the spoiler blades to make the brakes work smoothly. (These spoilers are activated by pushrods in the wing that lead to the servo in the fuselage.)



The wing-blade and wing-joiner assemblies also have their own illustrated drawings.

TAILPLANE AND ELEVATOR

Tailplane and elevator assembly is basically the same as that of the wing panel, but the tailplane tips are made of balsa blocks instead of the molded ABS plastic that's used on the wingtips.

A center line is drawn on the tailplane and on the fin's tailplane mount. Drill two 6.5mm holes along the fin's center line as shown on the plans, and epoxy two captive nuts at the base of the mount. The tailplane will be secured to these captive nuts on the fin with two nylon bolts.

INTERNAL FUSELAGE FITTINGS AND RADIO GEAR

The elevator bellcrank was factory-mounted at the base of the fin. Elevator control movement is activated from the bellcrank by a brass-tube pushrod that's fitted with clevises at the top and bottom.

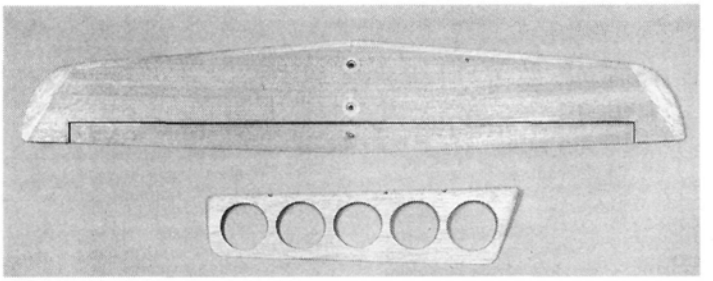
To help balance the plane, I installed the servo tray farther forward than shown on the plan: right behind the forward cabin bulkhead. To save even more weight in the rear, I ran pull/pull cables to the elevator and rudder servos instead of the kit's steel-wire pushrods.

Mount the aero-tow servo on the forward servo tray, and mount the spoiler servo tray in front of the wing blade mounts. Mount the battery and receiver as shown on the plans.

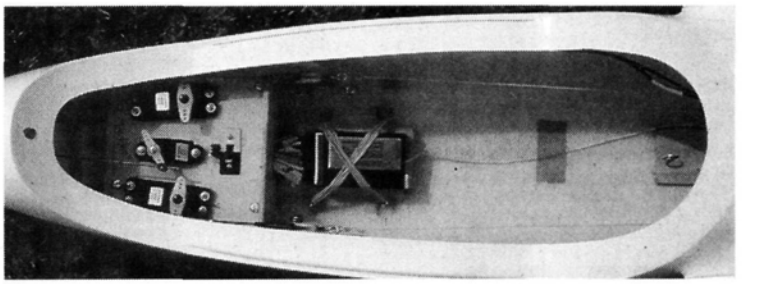
It's strange, but the plans don't show where the tow-hook should be mounted, and there's no mention of it in the instruction manual. One of my 4-meter gliders has its towhook mounted 5/8 inch in front of the CG, so I adopted this approach.

RUDDER AND FINAL ASSEMBLY

The rudder is made of solid balsa and is machine-shaped, so it requires little sanding. I cut five, 2-inch-diameter



The completed tailplane, elevator and rudder.



The cockpit is large enough to accommodate servos of any size, with room to spare.

lightening holes in the rudder, and this reduced its weight by 13 grams! Even after all this careful weight reduction in the rear, I still had to epoxy more than 12 ounces of lead shot into the nose to make the sailplane balance properly.

Hinge tape to hold the rudder on the fin is supplied with the kit, but I substituted Robart* hinges, because I wanted a more scale-like appearance.

I trimmed the canopy frame and fitted it to the fuselage. To anchor the canopy frame securely, I glued plastic shims to the mounting flanges on the fuselage.

The 1/4-scale instruments on the canopy-frame console are made by Wanitschek of Germany and sold by Hobby Lobby*, which also carries the aero-tow release mechanism. The 1/4-scale glider pilot is by A.H. Design and is offered by Balsa USA*. I used R/C 56 glue to mount the instruments, pilot and canopy in the canopy frame.

COVERING AND FINISHING

One 15-foot roll of Coverite* Black Baron film (white) was enough to cover all the flying surfaces, and it closely matches the bright white gelcoated fuselage, which required no painting.

I cut out the kit's Mylar trim-sheet decals with an X-Acto blade; I put them on the plane in the places shown in the kit-box photos. No other scale documentation was supplied.

PREFLIGHT

I balanced the model at the CG that's shown on the plans with the nose pointing slightly downward. The model's lateral balance was right on the money.

The recommended control-surface travel is: ailerons—14mm up, 7mm down; elevator—6mm up, 6mm down; flaps—4mm up, 6mm down; rudder—30mm right, 30mm left (coupled with the ailerons.).

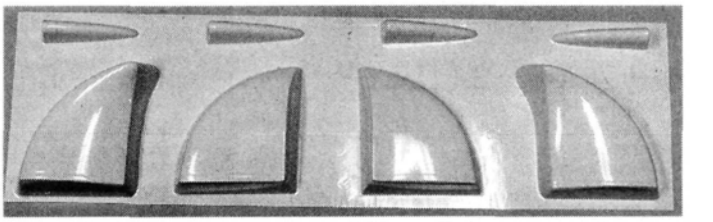
TEST-FLYING

With Paul Wohlrab (an experienced pilot and my good friend), I made several hearty hand-launches to check out the ASH 26-E's trim settings. Note that a model of this size should *never* be launched in a crosswind.

With an 8mph wind blowing in the right direction, we were ready for the test flight. Paul needed both hands to hold this 14 1/2-foot giant while he built up tension on the winch line. During the first few seconds of the launch, the tail dropped slightly, and then the sailplane regained a normal climb-out attitude with surprisingly little wing flexing.

At the top of the launch, I applied slight down-elevator and achieved a nice zoom release. At noon, when good thermals start to develop at our field, the sailplane rocked slightly. I immediately flew it in a graceful circle in the indicated lift area and slowly began to gain altitude. Aileron response was good, but a flip of the high-rate aileron switch on my transmitter quickly made the turning radius tighter and enabled me to ride the center of the thermal more efficiently. As initially set up, the plane had a slight tendency to balloon, but some down-trim helped to remedy this.

The lift lasted approximately 5 minutes, after which I decided to try a landing approach. The double-deck spoilers were very effective. The test flight had been fairly good, but the ballooning problem had to be solved. I checked the CG, and the balance point agreed with the plans.



The molded ABS wingtips and wing fairings eliminate the need to carve complex curves in balsa, and this reduces building time.

I called on fellow club member John Hauff for his opinion. John is one of the top ESL competitors on the East Coast contest circuit, always placing in the top 10 in the Expert category. After several test flights, we found that an 1/8-inch placed under the leading edge of the tailplane

(Continued on page 120)

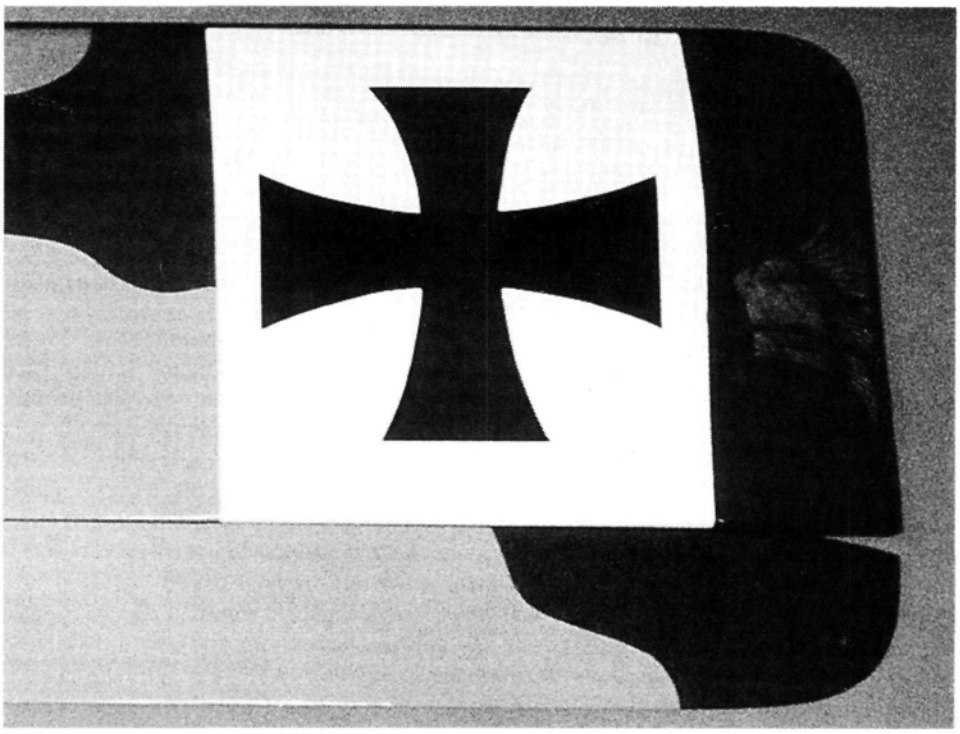
ASH 26-E AIRTRONICS VISION SETUP

Setup Number (1-8) =	**Model Name =**	**Template:**	**Date:**
MAIN Menu	**SURF ADJUST Menu**	**MIXERS: Menu**	**PRESET/DRs Menu**
Access Level (0-3) = 2	Center L Ail. (%) = 0	Ail-> Rud #1 (%) = 100	EPST #1 (%) = 0
SetupName (7 char) = ASH	Center L Flap (%) = 0	Ail-> Rud #2 (%) = 100	EPST #2 (%) = 0
Mode I or II, (II = norm) = II	Center R Flap (%) = 0	RfxA -> Rud (%) = 0	EPST Lch (%) = 0
Mode A or B, (A=default) = A	Center R Ail. (%) = 0	LAil-> RFlap (%) = 0	EPST Rfx (%) = 0
Cross Trims (Y-N) = Y	Center Elev. (%) = 0	RAil -> RFlap (%) = 0	Camb Rfx PST (%) = 28
Flap Stick Reverse (Y-N) = N	Center Rud. (%) = 0	Crow -> LAil (%) = 25	Camb Lch PST (%) = 0
CONFIGURATION Menu	**Ail. Diff. (%) = 30**	**Crow -> RAil (%) = 25**	**Flap Lch PST (%) = 0**
GearMode (Y-N) = Y	Land. Diff. (%) = 93	Camb -> LAil (%) = 45	Flap Lch PST (%) = 39
V Tail (Y-N) = N	Left Ail. LTV (%) = 65	Camb ->LFlap (%) = 66	Aileron DR (%) = 50
(L) Side Lever Rev (Y-N) = N	Left Ail. RTV (%) = 46	Camb ->RFlap (%) = 47	Elevator DR (%) = 60
Side Spl. (Y-N) [Y=Sp] = Y	Rt. Ail. LTV (%) = 46	Camb ->RAil (%) = 29	
Freeze Flap [enab] (Y-N) = N	Rt. Ail. RTV (%) = 65	DElev ->Camb (%) =0	
Ln Dsab Camb (Y-N) = N	Left Flap TV (%) = 50	UElev ->Camb (%) = 0	
Ln Hi A-> R M? (Y-N) = N	Rt. Flap TV (%) = 50	VTRDElev ->Camb (%) = 0	
Lc Hi A-> R M? (Y-N) = N	Elev. Up TV (%) = 70	VTRUElev->Ca (%) = 70	
Lc Dsab Ln (Y-N) = N	Elev. Dn TV (%) = 70	Camb -> Elev (%) = 0	
Rcvr. Type = PCM8	Rudder LTV (%) = 100	Spoil -> Elev (%) = 0	
Servo Rev. YYNNNNNN	Rudder RTV (%) = 100	Flap -> Elev (%) = 70	
1.3 ms Servo NNNNNNNN	Gear Tr.1 (PPM) = 66	Gear -> Elev (%) = 0	
	Gear TV.2 (PPM) = 66		
	Spoil./Camb. TV = 76		

HOW TO

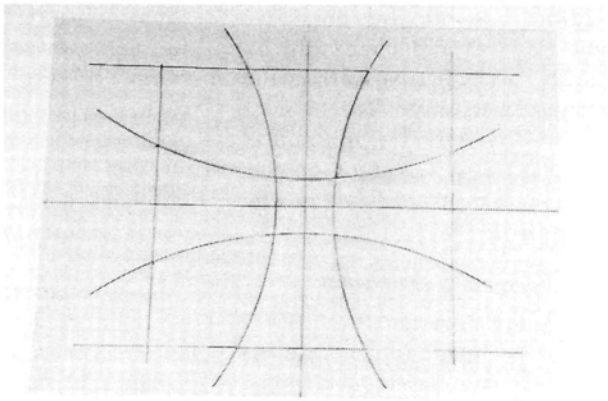
Making Insignias and Large Graphics

by FAYE STILLEY

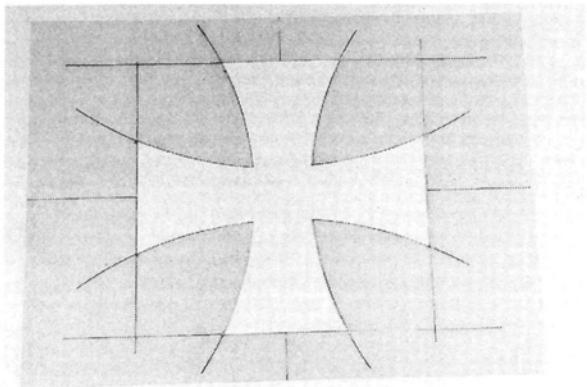


PUT MARKINGS OVER OPEN STRUCTURES—WITHOUT BUBBLES

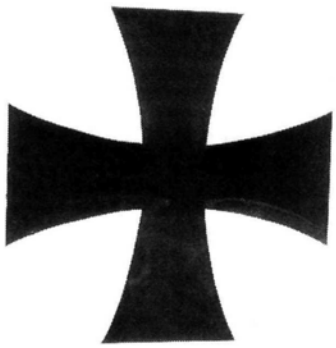
YOU CAN MAKE insignias and large graphics that can be applied over open-bay, built-up structures. To avoid the inevitable bubbles that occur when large pieces of film are sealed over film, I used the cutaway technique to make the large insignias on these wings. Above you see a finished wing panel with the insignia in place.



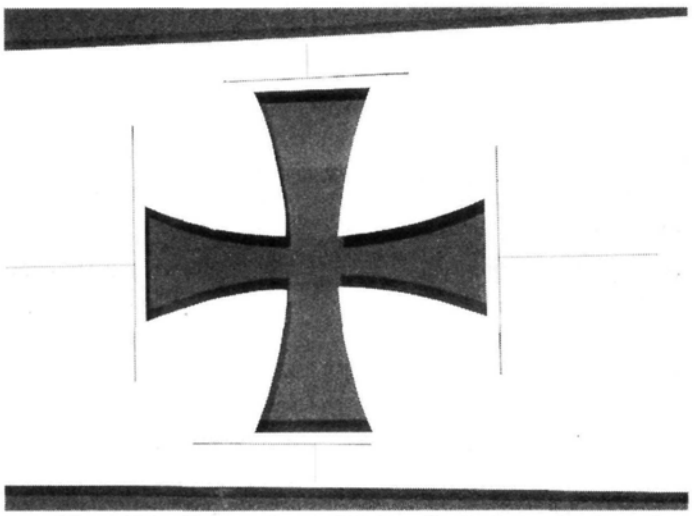
1 *First, make a pattern. In this case, I used a piece of Mylar; poster board works just as well. Draw the insignia on the pattern using a permanent-ink marker.*



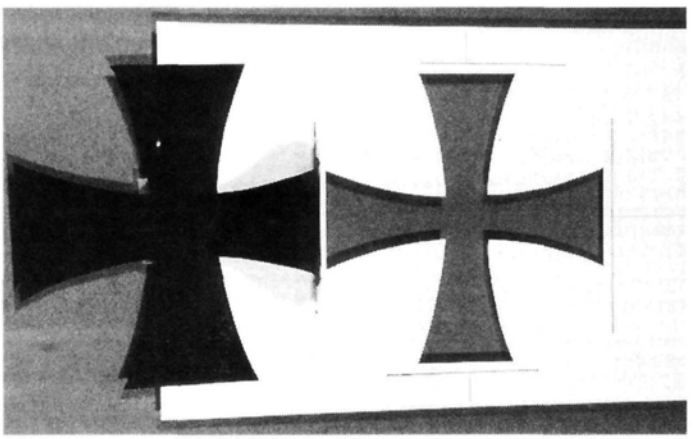
2 *Cut the insignia shape out of the pattern with a sharp modeling knife. Note that center lines are drawn on the pattern. These will be used later to ensure that the insignia is positioned properly on the background material.*



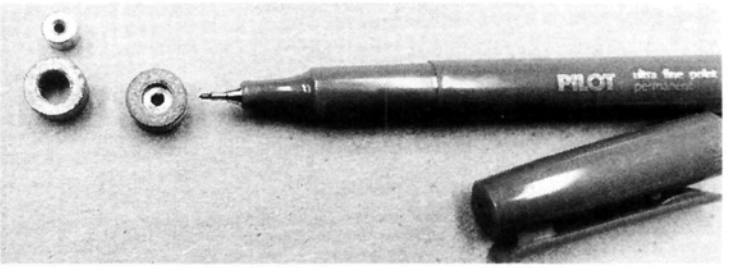
3 *Dampen the covering material for the insignia and rub it firmly onto a piece of glass to hold it in place. Using the pattern, draw the insignia (full-size) on the covering material and cut it out.*



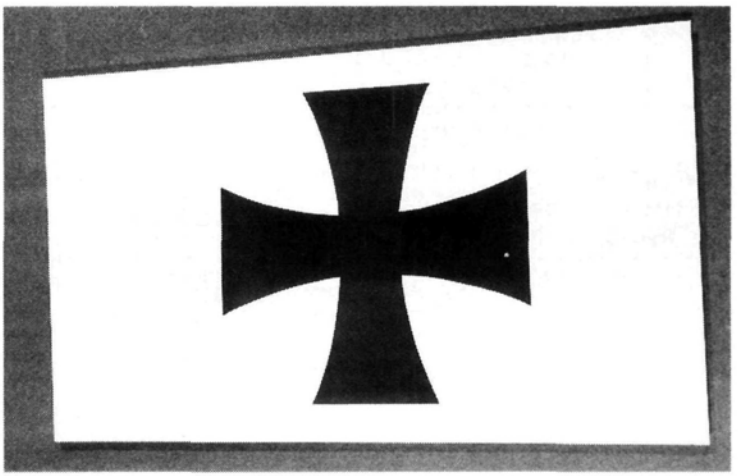
4 *After rubbing the covering material for the background color onto a piece of glass, use the pattern again. This time, use the pattern to mark the background material with the spacer and the pen. This creates the cutting line for the margin that will be on the underside of the seam. Remove the pattern and draw reference marks to help you position the insignia on the background. The marks indicate where the outer edges of the insignia will be placed.*



6 *Position the insignia using your reference marks. Rub it firmly onto the background material, and tape one side to form a "hinge." The tape "hinge" will hold the insignia in position when you seal it down. Be sure that the insignia and the background material are uniformly flat. When the two pieces of covering have been rubbed down, they must lie flat on the glass—as if they were one piece—to ensure uniform shrinking later on. Carefully peel the insignia off the background material.*



5 *To make a uniform seam, you can make a spacer to guide the marking pen. I made my spacer with a 1/16-inch-diameter wheel collar pressed into a 5/16-inch-diameter wheel collar. The distance from the center hole to the edge is almost exactly 3/16 inch. Insert the tip of a fine line marker into the center hole. The spacer acts like a wheel and guides the pen at a uniform distance from the edge of the pattern. Use a straightedge to measure and draw the straight lines.*



7 *Apply trim solvent sparingly to the margin area. (I use Top Flite's*. See my article, "Iron-On Camouflage," in the August '93 issue.) Too much solvent will melt the adhesive on the film; only a thin layer of solvent is necessary. Using a soft cotton cloth to avoid scratching the film, slowly roll the insignia back into place, rubbing it down firmly as you go. This section, with the insignia in place, will be ready for attachment to the other part of the wing covering after a 24-hour curing period.*

Before covering the wing, attach the film with the insignia on it to the other wing covering material by making an overlap seam in the same way as you attached the insignia to the background covering material. The darker color will overlap the lighter color by 3/16 inch.

Finally, add the wingtip color. In this case, make the seam with a sealing iron instead of trim solvent, because the seam is on a solid wood surface (the wingtip rib).

Stretch the covering material as much as possible when you tack it onto the wing airframe. This will allow you to use low heat to finish the shrinking. Too much heat can cause a seam to move and wrinkle. When you're doing the final shrinking, use as little heat as possible. Never blow hot air at the raw edge of a seam; blow the air over the smooth side of the seam.

Using a combination of solvent-sealing and heat-sealing techniques gives you the opportunity to make highly creative covering schemes. So, do something different: it's fun!

**Here's the address of the company mentioned in this article:*
Top Flite Models; *distributed by Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61826.* ■

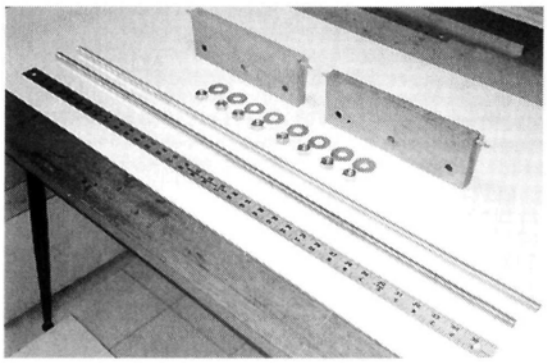
HOW TO

Build a Wing-a-Liner

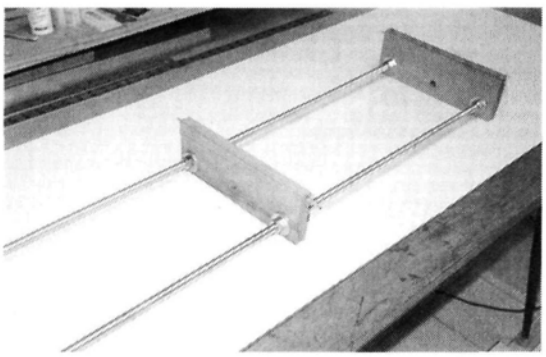
For perfectly straight wings

by JIM BENNER

THE WING-A-LINER is an inexpensive, easy-to-build fixture that's designed to ensure warp-free wings on models that have heat-shrink coverings. Light wings are particularly prone to twisting during the shrinking process. At a cost of less than $8 in materials, the Wing-a-Liner allows the builder to heat the covering uniformly on the top and the bottom while the wing is held in a true plane. It can also be used to straighten twisted wings and to achieve accurate, uniform washout.

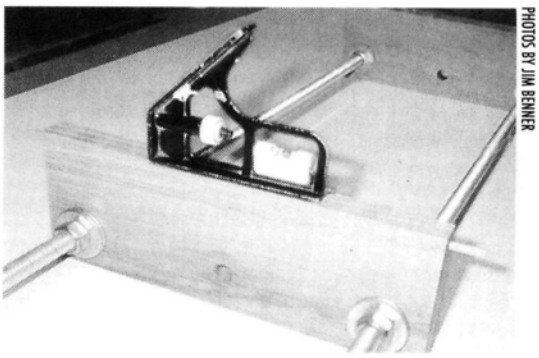


1 *You'll need a pair of ½-inch threaded rods, eight nuts, eight fender washers and two 1x4-inch oak (or another hardwood) rails. The rails should be 1 inch longer than the maximum wing chord you expect to use. (The rails shown are 10 inches long.) The positions of the ½-inch holes in the oak rails aren't critical as long as they're in the same place in each rail. A yardstick is shown for reference only.*



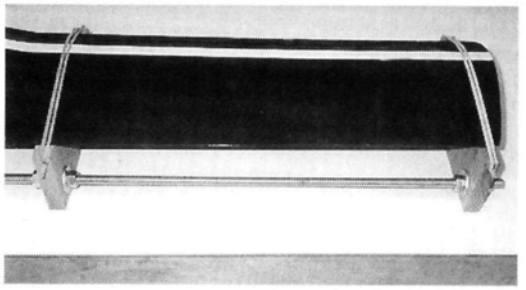
2 *Fully assembled, the Wing-a-Liner can be adjusted for use with wing panels of up to 33 inches in span. Note that in the ends of the rails, there are 3/16-inch dowels, which are used to anchor rubber bands. These should be ½ inch from the top surfaces of the rails and no more than ½ inch long.*

3 *The most critical step in setting up the Wing-a-Liner is to ensure that the tops of the rails are on the same plane. This is best accomplished using a level, but you can also eyeball it if you have a good eye. Applying a little oil between the bolts and the fender washers will help to minimize twisting when you tighten the bolts.*

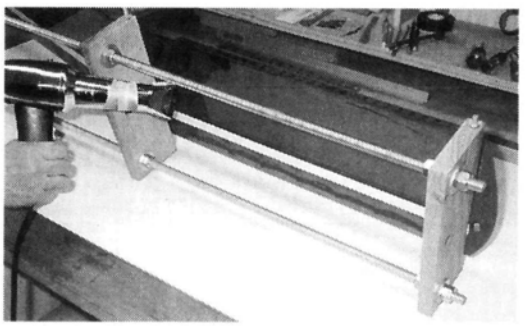


PHOTOS BY JIM BENNER

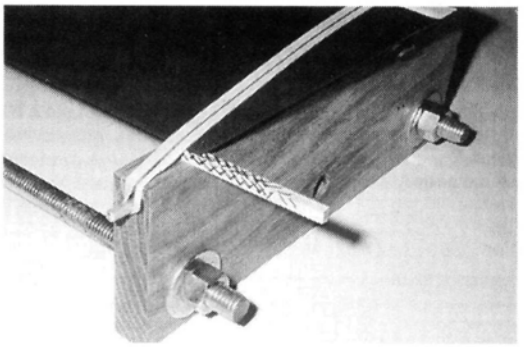
4 *Here's a wing panel attached to the Wing-a-Liner at the ends of its span (with rubber bands) and ready for the initial heat-shrinking. It's a good idea to shrink the areas around the rubber bands before you install the wing on the rails. Otherwise, the heat will make the rubber bands pop off. A cardboard heat shield is also effective in protecting them from the hot air blast.*

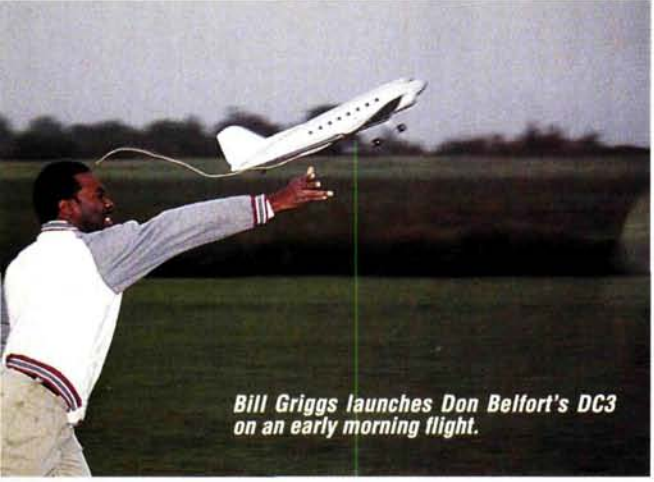


5 *When shrinking, tip the assembly onto its edge, and heat the top and the bottom alternately. Heat about two or three rib bays at a time. This minimizes residual stresses that can later cause distortion. Leave the panel on the Wing-a-Liner until the covering has cooled completely. Use the same procedure to straighten twisted wings. To offset spring-back, place a 1/16-inch shim under one corner of the wing to provide some over-twist.*

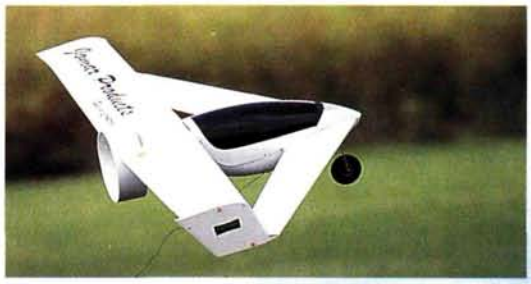


6 *The Wing-a-Liner is especially useful in achieving washout. Before the initial shrinking, place a shim that's as thick as the required washout under the trailing edge at the wingtip. Again, an extra 1/16-inch shim will offset spring-back. The shim thickness needed will vary with wing structure. If your first estimate is wrong, try a shim of another thickness, and re-shrink the panel.*





Bill Griggs launches Don Belfort's DC3 on an early morning flight.



Joe (Jomar) Utasi's Ligeti Stratos features a rocket-assisted takeoff. Joe chose not to demonstrate this feature but let the Stratos take off under its own power; Marx 300/10 motor; 16 cells.

'93 KRC ELECTRIC FLY

NEW TECHNOLOGY EMERGES

by BILL GRIGGS

Left: Bob Kress brought out his 8-cell P-38 Lightning stand-off-scale plane. It's a solid flier on one Cobalt .035 that drives a twin prop.

Right: Richard DeAngelis got up early on Sunday to fly his 1936 Flying Aces Stick. Powered by a Graupner Speed 400 4.8V motor with a mini Olympus gear drive, it flies on five SR 650mAh cells with an 8x4 Sonic Tronic prop. It weighs 21 ounces.

Walt Bub of Lebanon, CT, designed this large, stand-off-scale Grumman Wildcat to qualify for IMAA. It's powered by a geared Astro Flight Cobalt .40 on 18, 1400mAh cells, and it uses a Robart speed controller and a 15x10 prop. It's a slow, solid flier.

David Baron tried out a new Czechoslovakian Mega R5 motor (from Hobby Lobby*) in his 100-inch-span Heath Parasol. The motor uses 16 cells and an Astro gearbox.

I noticed Ellis Grumer's Osprey Autogyro spinning in a light breeze. The Astro .15 geared motor on 12 cells hasn't yet been flown.

Keith Mey of MDK introduced his first kit—a 1/16-scale B-17G. It has a polyester-resin fuselage and wing skins, foam wing-cores and vacuum-formed parts. This 11-pound model uses four Goldfire motors, 28 Panasonic 1700mAh cells, an Astro 205 speed controller and 7x6 props. It also has a bomb drop and retractable main and tail wheels.*

The Electric Express is a new kit from MEN. David Baron placed fourth in the All-up/Last-down event with one. Fred Schneider (seen here) also flew one. Its 72-inch-span curved wing set this plane apart from the rest.*

Here's Keith Shaw's sleek deHavilland Comet.

THE KEYSTONE R/C club has hosted the world's premier electric fun fly for the past 14 years. I have attended all but the first four of these meets, and each year has been better than the one before it. With 160 registered pilots and an "explosion" in technology, this year was particularly exciting. Several Aveox brushless motors and a new generation of composite electric sailplanes were on hand. The increasing number of F3E-type airplanes—true aerobatic rocketships—were a fascinating counterpoint to the giant-scale models that were exhibited and flown.

IT'S RAINING, IT'S POURING

Saturday, September 18, 1993, had to be the wettest day since Noah opened the doors on the ark. It rained most of the day, and many cars were stuck in the parking lot. Fortunately, a little rain has never stopped diehard electric fliers from throwing a plane at the sky. Those who arrived at dawn and left at sunset got the best weather for flying.

Many of the most intricate planes didn't fly on Saturday. Though there wasn't much wind, the builders of many of these fine ships decided to wait for fairer skies.

THE NEED FOR SPEED

There was a lot of sport flying, and I was particularly impressed by a converted Hots Elliptic owned by Canadian Pat Mackenzie. This Astro FAI .40-powered ship had more vertical power than Michael Jordan in a thermal. What a *hot* performer! Pat belongs to a very active group—The Electric Model Flyers of Southern Ontario—and quite a few of their members made the trip.

This first-place (Scale) Dornier DI is the work of Steven Stratt of AirDrome Models. It has: moving cockpit controls, aluminum skin with "rivets," a dummy BMW engine and a three-color wing. Magnificent flier! Motor—Astro geared 40; 18, 1500mAh cells; wingspan—56 in.; weight—7 lb, 7 oz. Order plans from AirDrome.*

PHOTOS BY BILL GRIGGS & TOM ATWOOD

Nathan Bousquet and his dad modified a Senior Telemaster to carry a Canon VC-1 videocamera. The 12-pound (with camera) model is powered by an Astro .40 geared motor on 21 cells; 14x8.5 prop.

Another hot performer was the E-REX—an original-design pattern plane. Ed Berchtold designed it around an Astro Cobalt .40 on 18 1400mAh SCR cells. With an all-up weight of 5 pounds and a wing loading of only 14 ounces per square foot, the E-Rex could do the entire pattern.

Don Belfort is a longtime flying friend and regular at the KRC meet. Don flew about five planes this year instead of his usual 10. Don flew a Pa-ket Ra-ket—a little pylon racer that I designed. *[Editor's note: as described in Mitch Polings' October '93 "Electrics" column, these little racers designed around the Speed 400 motor series are very popular in Europe.]* Don's model gets about 3 minutes of flight time from the 600mAh cells.

Don also had a Kress Jet Fiesler V-1 Buzz Bomb ducted fan. He uses a new fan unit—the E-Jet*—and an Astro FAI .035 on six cells. (See "Air Scoop" in this issue for a photo of the E-Jet.) The E-Jet is roughly the size of the units used by Keith Shaw in his beautiful Horten flying wing. The E-Jet uses a special belt drive to turn its rotor at 32,000 rpm, and it produces about 17 ounces of static thrust. Special thanks go to Walter Mitchell—the designer of the E-Jet—for making a special effort to get these prototype fan units to Don and me in time for the KRC meet.

This Boeing 314 Yankee Clipper flying boat was scratch-built by Art Thoms of Berkeley Heights, NJ. It's powered by four geared Cobalt .05 motors and 32 cells, and it has Grish 10x6 three-blade props. It's flown off water 11 times.

BY LAND AND SEA

There were a lot of seaplanes and flying boats at this year's meet. The popularity of the Ace PuddleMaster isn't surprising because it flies well. At least 15 of these little amphibians flew.

Two flying-boat models really struck my fancy. One was an extremely large, 1/16-scale, Boeing 314 Yankee Clipper that was scratch-built by Art Thoms of Berkeley Heights, NJ. This 9 1/2-foot-long, 15-pound monster is powered by four Cobalt .05 geared motors on 32 cells. Art didn't fly the Clipper because it only flies off water.

The other flying boat that caught my attention was a PBY5 Catalina flown by 12-year-old Nathan Bousquet of Narragansett, RI. Built from an Easy Built kit, the model uses two Graupner Speed 400 motors powered by eight 800mAh cells. It was meticulously detailed and even had manually retractable tip floats. Nathan and his dad really did a super job on this one.

On Friday, Larry Sribnick of SR Batteries sponsored a night flying session. More than 20 planes flew, and about 100 people attended. Each year, Larry gives a battery seminar that teaches modelers how to use their Ni-Cds to best effect. The informative seminars are always well-attended.

I also flew Larry's Airtronics Falcon 550E. Larry has been experimenting with its CG—it was so far aft as to be on the verge of instability—but when it entered lift, it really climbed. I like the way the Falcon flies, but I'm not as daring with my CG. Thanks for the flight, Larry.

ALL-UP/LAST-DOWN

The All-up/Last-down event is perhaps the most popular contest of the meet. It's held on both days to give as many pilots as possible a chance to compete. It seems to take longer each year. On Saturday, the last two competitors flew for over 58 minutes—nearly twice as long as the third-place finisher. The day starts to wind down after that, and many people head for their hotels or homes to get ready for the annual "social."

Yes, it does fly! Mike Stewart built this Sky Dart from Model Airplane News plans. It's a four-times-scale paper airplane. It showed a strange tendency to wallow in wind. Motor—Astro .020 Cobalt; five 1000mAh cells; weight—1 pound, 10 ounces.

FRIDAY NIGHT DINNER

Hundreds of attendees took part in the banquet, which was held at a local firehouse. The food was good, and the atmosphere was congenial and festive. The Keytstone R/C Club organized a special raffle to benefit the AMA's national flying-site fund, and they guaranteed a dona-

WINNERS

SATURDAY

20 Loops, Fastest Time: Ron Bates—40.80 seconds

All-up/Last-down: Doug Holland—59 minutes

Best Scale: Steven Stratt—Dornier DI

Best Technical Achievement: Keith Shaw—Horten IX V2b

SUNDAY

30 Rolls, Fastest Time: Dave Baron—19.75 seconds

All-up/Last-down: John McCullough—30 minutes

Best Old-Timer: Karl Benson—Gas Bird

CD's Choice: Pat MacKenzie—Citabria

tion of at least $500. Dave Polombo of Aveox donated a brushless motor to the raffle, and the proceeds were included in the donation. Bud Klopp, the AMA associate vice president (representing Bob Brown, the District III vice president) received the check from Bob Lane, with Dave Polombo standing by.

Joe Beshar, District II AMA vice president, presented the Keystone R/C Club with the Gold Leader Club award (the highest level of club recognition offered by the AMA). Tie tacks were presented to each member of the club.

Because the rain and traffic damaged the field, the fliers "passed the hat" for donations to restore it. By the end of the next day, $550 had been collected. This said a lot about the spirit of the meet.

Twelve-year-old Nathan Bousquet of Narragansett, RI, flew this Easy Built PBY5 Catalina. Two Graupner Speed 400 motors on eight 800mAh batteries move this plane around nicely.

THE FRENZY

I arrived at the field at dawn on Sunday. The skies were still slightly overcast, but they cleared as the day progressed. I arrived early with the hope of seeing some of the smaller planes fly before the wind picked up, and I wasn't disappointed. Don Belfort flew his tiny DC3 and Pa-ket Ra-ket, and Rich DeAngelis flew a Flying Aces stick. By 7 a.m., perhaps a dozen flights had been made.

The sky was soon full of planes as everyone tried to make up for lost time. People come to KRC to fly, and fly they did. David Baron flew Steven Stratt's unbelievable Dornier DI Zeppelin. The DI is a new plan from AirDrome, and it can best be described as "master scale." It has a working control stick, a rudder bar, scale rivets, a dummy BMW engine and a fully detailed cockpit; it's a true labor of love. The surprising thing for me was the completely aerobatic and graceful way this plane flew.

Another plane that stopped all activity at the field was Ken Stinson's C-130 with four Pittman motors driving four-blade props. This 85-inch plane looked too big to fly, but it was a real treat in the air. The sound of multiple props is unforgettable.

TRENDS

The biggest trend I noticed this year was that sport planes outnumbered gliders for the first time. People now know how to build electric performance planes. Many glow-powered designs had been successfully converted to electric.

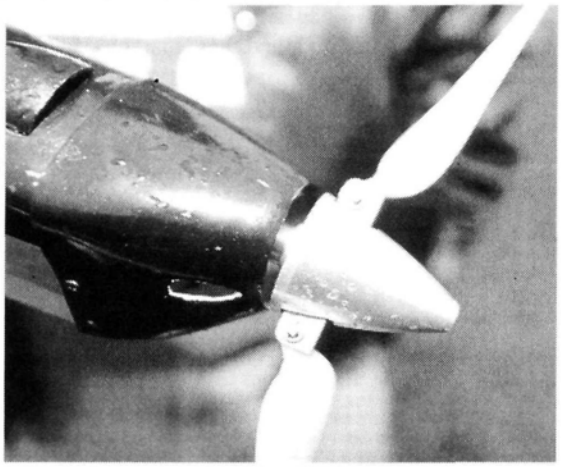
There were also at least 20 F3B-style planes swooping all over the place. Most of the pilots of these airplanes flew them as if they were pattern planes. Their

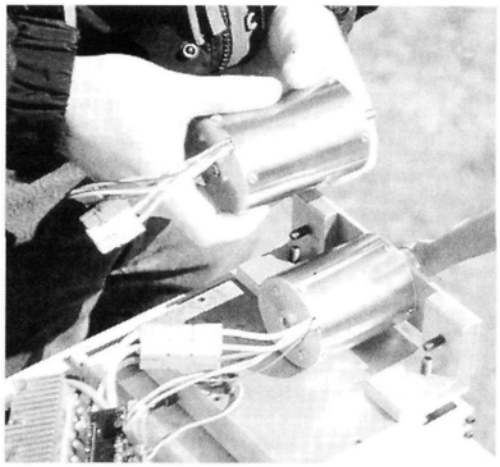
Get Your Red-Hot...

One of the nice things about the KRC meet is that it's also a mini trade show. Because most electric items come from "cottage industry" producers with limited budgets, this is one of the few times you can see electric products up close. Here are a few of the new products:

David Palombo—the creator of Aveox* brushless motors—made the trip all the way from California. This was the first time I'd seen one of these new motors in action. Keith Shaw flew a JM Glasscraft pattern plane, which was powered by an Aveox motor, with great authority. Running his Aveox 1409-5 motor for 24 minutes on a 1700mAh Panasonic battery pack, David Baron placed fourth in the All-up/Last-down.

I was very impressed by a large prototype motor that Aveox developed for a Navy target drone program. The drone is rocketed from a destroyer, and then its wings unfold and the electric motor takes over. The drone weighs 60 pounds and has a wing loading of 160 ounces per square foot. This motor isn't for the faint of heart—particularly considering the cost of 70 volts of batteries. Aveox produces a slightly smaller version for F3E applications (see photo). This motor really opens up the field of monster-scale electric aircraft. How about a couple of these in an ultralight? Hmmm....





Above left: Larry Verna of Troy, MI, had a prototype electric spinner from Tru-Turn. Rick Obenberger made a special slot in a small Tru-Turn spinner (Their smallest has a backing plate only 1½ inch in diameter.) to fit Sonic Tronics props. Above right: David Palombo designed Aveox brushless motors and speed controllers. The commutation in a brushless motor is done electronically (instead of mechanically as in a brushed motor). The magnet spins in the middle. Motors are available in two sizes, and several winding combinations are available. The larger motor shown here was developed for a drone. The one in the test stand is for F3E ships.

Ed Slegers of Slegers International* is on his way to becoming a major force in the electrics market. Ed carries many sailplane lines, including models from Brian Agnew and Airtronics. The ready-to-fly, F3E ships from Model Airplane Products (MAP) of France really made me salivate. The Aura 2 has a foam wing (Rohacell shell construction, with pre-cut servo bays) with carbon-fiber spars and fiberglass and carbon mat skins. All the control surfaces are hinged. It comes in two versions—a 10-cell size and one that can handle up to 27

power-to-weight ratio leads to some wild aerobatics.

Scale planes are also showing up in increasing numbers. I think electric scale is popular because there's no vibration to shake off the intricate surface details, and there's no fuel residue to fade the paint schemes. Multi-engine planes are a snap when you don't have to worry about synchronization or engine-out problems.

The availability of ducted-fan rotors has sparked jet activity. I expect to see increased growth in this new area as more is learned about matching the fan size to the airframes.

I noticed a sharp increase in the number of young people taking part in this hobby. Justin Pribanic and Nathan Bousquet are just two examples. Both flew a variety of airplanes during the weekend.

I have only one suggestion for future meets: I think that the daily demonstration flight should be expanded to include outstanding planes chosen by the contest director. Attendees miss many excellent flights simply because they aren't looking at the right time!

WINDING DOWN

Things wound down on Sunday after the All-up/Last-down, because many people left early to make the long trip home. The KRC folks make everyone feel like part of the family; the friendships that I cultivate each year always bring me back.

A final note: KRC is sponsoring a contest for photos and/or videotapes that best capture the spirit and activity of the event. The prizes haven't been determined, and any submittals become the property of KRC. Send yours to Bob Lane.

Ken Stinson scratch-built this C130 from a three-view in the December '81 issue of Model Airplane News. He rewound four Pittman motors (not commercially available) and used 3:1 Master Airscrew gearboxes. Wingspan—85 inches; area—839 square inches; wing loading—23 ounces per square foot; weight—8.5 pounds.

**Here are addresses that are pertinent to this article:*

Hobby Lobby Intl., *5614 Franklin Pike Cr., Brentwood, TN 37027.*

Bob Lane, *1980 Hickory Dr., Harlesville, PA 19438; (215) 234-4104.*

Aveox Inc., *P.O. Box 1287, Agoura Hills, CA 91376-1287.*

Slegers International, *Rte. 15, Wharton, NJ 07885; (201) 366-0880.*

American Fun Fly, *7543 Maple Ave., Pulasky, NY 13142; (315) 298-3630.*

The Institute of Silent Flight, *P.O. Box 430, Morgantown, PA 19543; (215) 286-5129.*

MDK, *221 Whitepond Rd., Stormville, NY 12582; (914) 878-9594.*

Boxmeyer Composites, *P.O. Box 6165, Philadelphia, PA 19115; (215) 333-8833.*

Model Engineering of Norwalk, *54 Chestnut Hill Rd., Norwalk, CT 06851; (203) 846-9090.*

Flightec, *21 Juniper Way, Hamilton, NJ 06816; (609) 584-9409.*

E-Jet; *distributed by Walter Mitchell, 5320 Ravenna Ave., N.E. Seattle, WA 98105.*

AirDrome, *P.O. Box 1425, FDR Station, New York, NY 10150; (212) 421-14400.*

Tru-Turn, *P.O. Box 836, South Houston, TX 77587.* ■

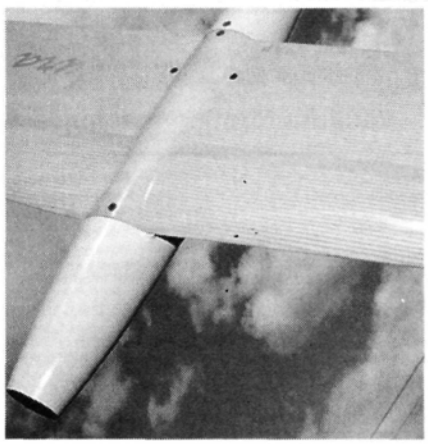
cells and a 60 motor (this one has solid foam wings). The MAP line shows superb workmanship and beautiful lines.

American Fun Fly* is a newcomer to the electric market. Darryl Sanford started the company when he became frustrated trying to find all the little "add-ons" that make a good working electric system. Darryl offers a series of powerful ferrite motors with gearboxes, and he optimizes their performance by offering a suitable prop, speed controller, connectors, wires and batteries. All you add is the airframe.

Darryl and several members of SEFLI stayed up late on Saturday night to help a modeler install a PDP15 (Pretty Darned Powerful 15) system in a Psychomax flying wing. On Sunday, they flew the plane and really impressed the crowd. The plane was fast, completely aerobatic and actually flew longer. It's a really nice system that won't break your piggybank.

Elliott Boulous started The Institute of Silent Flight* to provide silent-flight information and equipment at discount prices. Elliot's trailer is full of electric and glider goodies; he offers many hard-to-find kits and several obscure scale gliders such as the Minimoa and Libells. The neat part is that Elliott has been known to barter.

This 7.5- to 8-pound plane, which did not fly at the meet, is loosely based on the NASA AMES AD1 and is built with Tufflight. The wing pivots to a 60-degree angle relative to the fuselage, on a ¾-inch-diameter aircraft-aluminum tube using a ¼-scale servo. The 86-inch-span, 67-inch-long model has 860 square inches of area and is powered by an Astro geared 40 motor and a 21-cell 1500mAh SR pack. It's available from Boxmeyer Composites*. Tufflight can be used to build a stressed-skin structure in any shape except a compound curve.



Ed Slegers exhibited the Aura 2 ready-to-fly, 10-cell F3B ship. It has a hollow-core Rohacell wing with a carbon-fiber spar. The entire wing is covered by fiberglass and carbon-fiber matting. A 27-cell version has a solid, reinforced foam wing. White foam T-tail has carbon fiber for strength; fuselage is carbon-fiber and Kevlar. Imported from France.

Darryl Sanford and I had dinner with Elliott and his wife, Mary. We also nosed around a bit at the Institute. I was in heaven. Everywhere I looked there was something new and exciting to play with. I left with a German F3B ship and a Razor 1 flying-wing slope-racer kit.

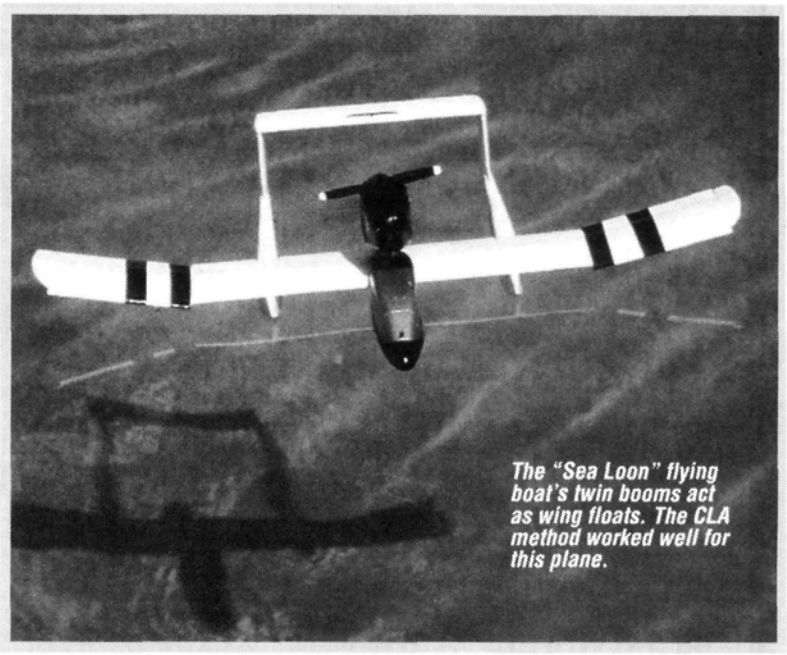
These are just a few of a growing number of new companies that specialize in silent flight. Who will be the first to host an all-electric trade show?

HOW TO

BY ANDY LENNON

Vertical Tail Design

Secrets of spiral stability



The "Sea Loon" flying boat's twin booms act as wing floats. The CLA method worked well for this plane.

VERTICAL TAIL DESIGN is more complex than one might imagine. It involves consideration of wing dihedral, fuselage and landing-gear side areas, CG location and the important vertical tail area.

The "Swan" Canard has bicycle landing gear partly buried in the lower fuselage. The front wheel is steerable.

A brief summary of model airplane history is timely. In the 1930s, models were light, tissue-covered and rubber-band powered. To fly properly, they depended solely on their inherent stability.

The small, single-cylinder gasoline engine, such as the Brown Jr., with its fuel tank, ignition coil, condenser and battery revolutionized model aviation. Gas models were bigger, heavier and flew faster and longer. They still depended on inherent stability to avoid damaging crashes. Radio control was still ahead.

Early R/C "rudder-only" models still relied on the model's inherent stability. Rudder control really only "steered" the model.

It became apparent that there was a serious spiral instability problem. Models were spiral-diving into the ground.

CENTER OF LATERAL AREA CONCEPT

In 1941, Charles Hampton Grant, then editor of *Model Airplane News*, published his Center of Lateral Area (CLA) theories, in his book "Model Airplane Design." "Lateral area" refers to aircraft surface areas that face sideways. This theory, in a nutshell, states that if:

- the model's CLA was at about 25 percent of the tail moment arm aft of the CG; and
- a line through CLA and CG was horizontal; and
- the line joining the front CLA and the rear CLA sloped upward to the front, then the model would be spirally stable. Figure 4.1 illustrates the layout required by this theory.

Put into practice by many modelers, this theory was proven time and time again and was applied in the early days of rudder-only R/C by such well-known, respected modelers as Hal deBolt and Bill Winter. The latter's beautiful "Cloud-Niner" (outlined in Figure 4.1 and published in the October '91 *Radio Control Modeler)* still reflects Charlie Grant's ideas.

Today, with the very precise, powerful and reliable control provided by modern R/C equipment, which permits unlimited aerobatics, this theory is less important, but nonetheless valid.

INERTIAL ROLL COUPLING

This author surmises that inertial coupling in rolling plays as big a part as side areas in understanding Grant's CLA ideas.

The mass of a model airplane is concentrated in two elements, one representing the

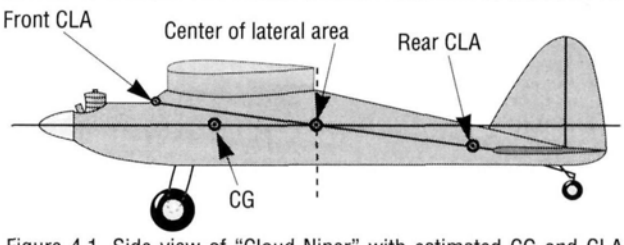


Figure 4.1. Side view of "Cloud-Niner" with estimated CG and CLA locations.

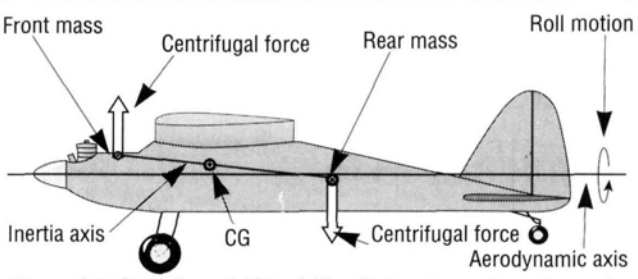


Figure 4.2. Side view of "Cloud-Niner" showing estimated aerodynamic and inertial axis.

mass ahead of the CG and the other, the mass behind the CG.

There are thus two principal axis systems to consider:

- the aerodynamic, or wind, axis, through the CG, in the relative wind direction.
- the inertial axis through the CG, joining the two element masses (see Figure 4.2).

If, in level flight, the aerodynamic and inertial axes are aligned, no inertial coupling will result from rolling motion.

However, if the inertial axis is inclined to the aerodynamic axis, as in Grant's theory, rotation about the aerodynamic axis will create centrifugal forces that, through the action of inertial forces, cause a pitching moment. This is "inertial roll coupling" (see Figure 4.2).

Since the inertial axis slopes upward to the front, a nose-up pitch will occur when the model rolls. This prevents the fatal spiral dive. This type of spiral stability is great for sport models, but the inertial coupling must inhibit any maneuver where rolling is involved.

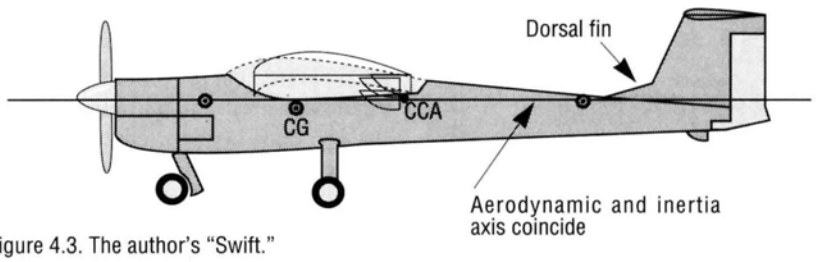


Figure 4.3. The author's "Swift."

DIHEDRAL ANGLES

For powered R/C models with ailerons, the following dihedral angles are suggested:

- **High wing—2 degrees**
- **Mid wing—3 degrees**
- **Low wing—4 degrees**

Sweep back also has a dihedral effect. Two to 3 degrees of sweep back is equivalent to 1 degree of dihedral.

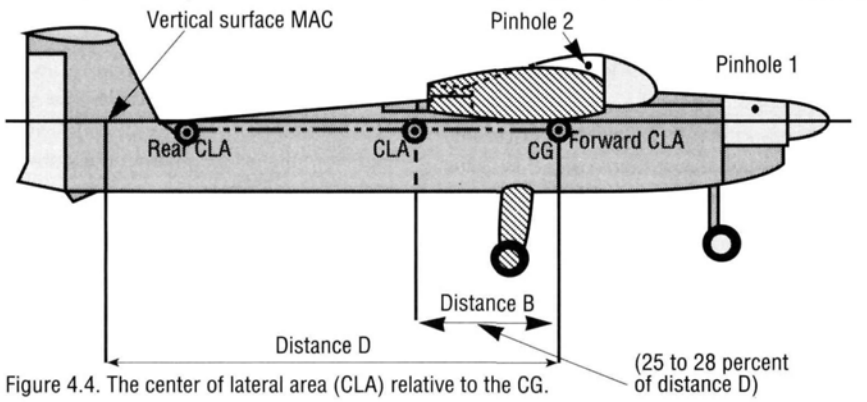


Figure 4.4. The center of lateral area (CLA) relative to the CG.

Figure 4.3 shows a side view of the author's Swift (published in the October '93 issue). The CLA is at 25 percent of the tail-moment arm, as per Grant, but the positions of the two element masses make the aerodynamic and inertial axes almost coincide. In rolling, no inertial coupling (that could interfere with aerobatics) will occur. Pattern models have similar configurations.

DIHEDRAL

With modern radio control and ailerons, the high dihedral angles that were built into free-flight or rudder-only models is not needed.

VERTICAL TAIL AREA

The following procedure has been used by this author for many years and on many models—all successful fliers—to determine vertical tail area. It is applicable to all configurations, flying boats, canards, floatplanes, etc.

In his "full-scale" book, "The Design of the Aeroplane," British aerodynamicist and author Darrol Stinton recommends a very similar procedure.

The author of a widely read book on model aerodynamics devotes a page-and-a-half to attempting to disparage Grant's well-proven theory. Unfortunately, he is completely negative and offers no solution of his own, other than a vague statement that "fin and dihedral do need to be considered together"—exactly what Grant's procedure does!

LOCATING THE CLA

Cut out a cardboard profile of your design, full size, that represents the lateral surfaces of the aircraft. For two lateral surfaces, e.g., for the right and left sides of the fuselage, a single cardboard profile cutout will suffice. If there are more than two stacked lateral surfaces (viewing the plane from the side), e.g., the wing's dihedral, landing-gear or vertical tail surfaces, an additional piece of cardboard will have to be layered on the profile to reflect the additional pair of surfaces. Add the necessary layers of cardboard as shown cross-hatched in Figure 4.4. Note that for this configuration, at the wing, three layers would be needed: two for the wings' side areas (because of dihedral, each wing has a left and right "lateral surface" comprised of the vertical rise in the wing, as seen from the side) and one for the canopy outline.

Size your vertical tail surface to an area that looks right. You'll soon find out how

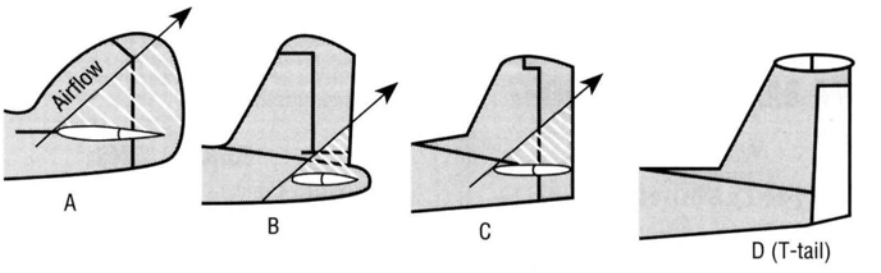


Figure 4.5. Blanketing of the vertical tail in a spin, as affected by the position of the horizontal tail.

accurate your estimate was.

To locate the CLA of this profile, simply establish its CG. It is easily done by inserting a pin through the profile at pinhole 1, in Figure 4.4; push the pin into some vertical surface, door jamb, or edge, and allow the profile to hang free under gravity. Make a loop at one end of a 3-foot length of string, and slip it over the pinhead; to the other end of the string, tie a small weight, e.g., a nut, key, or paperclip. Allow it, too, to hang free under gravity.

The profile's CG will be somewhere along the thread line; mark this line on the profile. Repeat this procedure from another point, somewhat distant from pinhole 1. In Figure 4.4, this is shown as pinhole 2.

Where the two thread lines intersect is the cardboard profile's CG and your model's first CLA. The CG (and CLA) will not, in all probability, be at 25 percent of TMA; reduce or add to your vertical surface area until it does. You may have to repeat this process several times to get the right tail area/CLA relationship—unless you are smarter than this author (which could well be!)

VERTICAL-TAIL ASPECT RATIO

The aspect ratio (AR) of horizontal and vertical tails (and wings) bears on their effectiveness. Vertical-tail aspect ratios of 2.5 to 3 are suggested. To determine your VT's AR use this formula:

$$ARv = \frac{1.55 \times Bv^2}{Sv}$$

where:
ARv = vertical tail aspect ratio;
Bv^2 = height of vertical tail from fuselage bottom, in inches, "squared";
Sv = vertical tail area in square inches, including fuselage below the fin.

A T-tail capping the vertical tail surface, as in the "Swift," effectively increases the vertical tail's AR effect.

VERTICAL TAIL BLANKETING

Figure 4.5 shows how the horizontal tail could dangerously blanket the vertical surface in a spin. The T-tail in Figure 4.5D is not blanketed in this way.

DORSAL FINS

The Swift, Figure 4.3, has a small dorsal fin. It has three useful functions:
• increases fuselage stability at high side slip angles;
• reduces vertical tail stalling;
• just plain looks good!; gives the impression that its designer knows what it is all about!

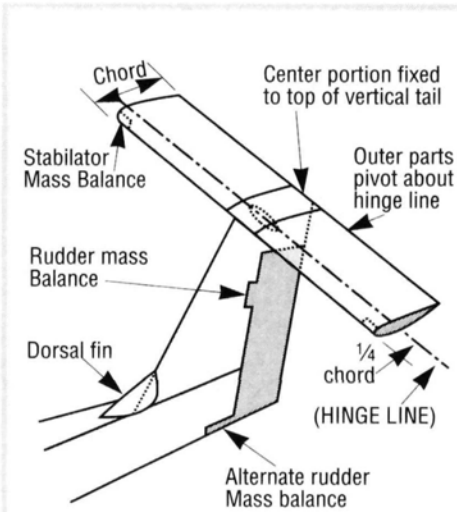


Figure 4.6. Perspective drawing of an all-moving horizontal T-tail or stabilator.

A Dorsal fin area of 10 percent of vertical tail area is suggested.

ALL MOVING HORIZONTAL T-TAILS

Figure 4.6 sketches an all-moving T-tail or "stabilator" that's suitable both for powered models and for sailplanes; for the latter, mass balancing may not be required if the glider is intended to fly at a relatively low speed. A "T" stabilator's area may be reduced 10 percent from that of a conventional stab-elevator horizontal tail plane.

RUDDER POWER

For powered sport models, a rudder area of 30 percent of the vertical tail area, with angular travel of 30 degrees either side of neutral, is suggested. For sailplanes with high-AR wings and for pattern ships, a rudder area up to 50 percent of the vertical tail area is recommended.

RUDDER AILERON EFFECT

A rudder that has its "area-center" above a horizontal tail line through the CG will act like an aileron when used. It induces a roll that is opposed to the rudder-forced yaw.

To avoid this, the rudder's area center should come close to or fall on the horizontal line through the CG. The portion below the CG opposes and neutralizes the rolling action of the portion above the CG (Figure 4.1), and the rudder action causes yaw only.

Upwardly dihedral V-tails have pronounced anti-yaw roll action when the rudervators act as rudders. Downwardly dihedralled (anhedralled) V-tails have rolling action in the same direction as the yaw.

This is the final part of this series . I hope it has been useful. ■

MODEL AIRPLANE NEWS MAGAZINE
FIELD & BENCH REVIEW

Smaller in size but not in performance

LANIER Stinger 120

by DICK PURDY

PHOTOS BY TOM ATWOOD

THE EDITOR-IN-CHIEF of *Model Airplane News* asked me whether I'd be interested in doing a kit review of the Lanier* Stinger 120, but he wanted something more than just a kit review; he also requested that I compare some muffler and fuel options.

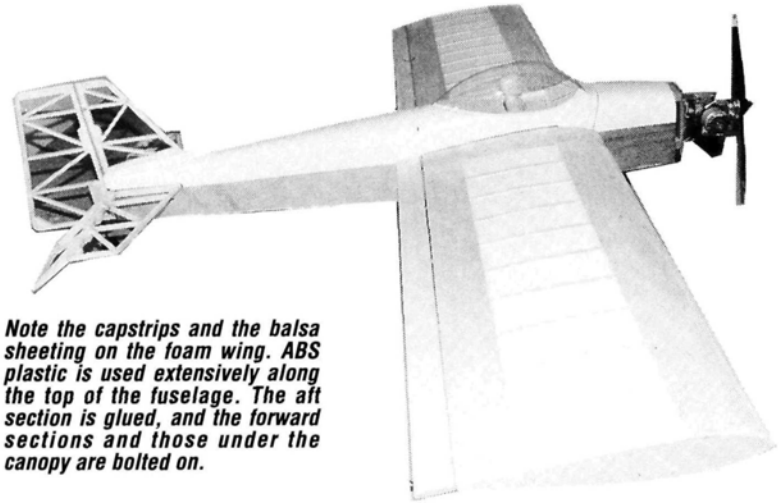
The powerplant we chose to use is the O.S.* 108. We decided to compare the Slimline* and Davis Diesel* mufflers using methanol for fuel and to test a "dieselized" version (by adding a Davis Diesel diesel head), too. How would the choice of mufflers affect performance and dB levels?; and would the plane be a more aggressive "aerobat" running on diesel fuel? We could hardly wait to find out.

I first saw the Stinger 120 at the WRAM show in White Plains, NY, in February '93. There was no question that it would be an exciting project. Hence, I secured the kit, and construction started at once.

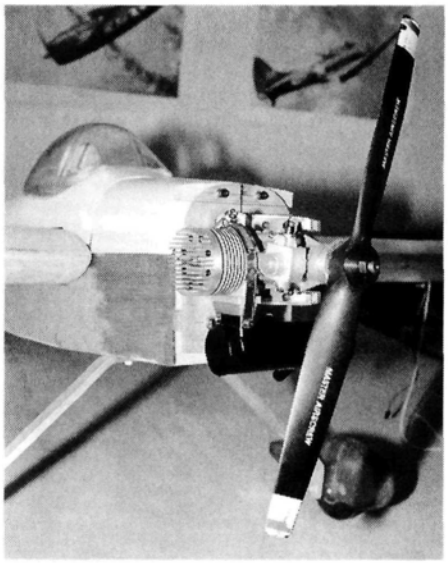
CONSTRUCTION

Constructing the Stinger is not complicated because several of the parts, e.g., the turtle deck, cockpit, tank cover and cowl, are pre-formed plastic. The bubble canopy and wheel pants are also pre-formed to minimize building time.

The formed Dural landing gear is made of the heaviest bar-stock aluminum I've ever seen on a model, and it is *rugged.* The foam-core wing is symmetrical and dead straight, without dihedral. There's an eight-page instruction manual, which is a no-nonsense guide. The hardware is not provided, but the manual contains a complete list of items needed and suggested manufacturers. The builder can select his preferred hardware.



Note the capstrips and the balsa sheeting on the foam wing. ABS plastic is used extensively along the top of the fuselage. The aft section is glued, and the forward sections and those under the canopy are bolted on.



Mounted on the O.S. 1.08, this Master Airscrew 15x8 propeller was used to test the Slimline and Soundmaster mufflers. Although the tests were not extensive enough to be scientifically definitive, we did see a trend. At 9,000rpm, the Soundmaster was consistently 2 to 3dBs quieter than the Slimline. In this photo, two mounting beams of a Fema onboard starter can be seen just beyond the far side of the engine (the starter was later removed to save weight). In one test, the Soundmaster produced 200 more rpm than the Slimline at full throttle, but in another, 200rpm less, so we were unable to draw any conclusions regarding power. Note the Soundmaster muffler we used, selected for its small size and suitability for a diesel conversion, was the Q-90. This muffler was originally designed for a .90ci 2-stroke and required an adapter to fit on the O.S. 1.08.

SPECIFICATIONS

Model name: Stinger 120
Type: Aerobatic/sport
Manufacturer: Lanier R/C
List price: $249.95
Wingspan: 80½ in. or 72 in.
Wing area: 1,242 sq.in.
Weight: 14.3 lb. (as built)
Wing loading: 26.5 oz. per sq.ft.
Length: 61 in.
Engine used: O.S. Max 1.08 (using methanol and diesel)
No. of channels req'd: 4
Props used: APC* 15x8 and 15x11 (diesel), Master Airscrew* 15x8, Zinger* 18x8 (diesel)
Radio used: JR X-347
Wing construction: Foam-core
Airfoil type: Symmetrical

Hits

- Kit is reasonably priced.
- Fairly fast construction; uncomplicated.
- Very strong.
- Terrific aerobatic flier.
- Moderate wing loading allows easy landings.
- Good-looking.

Misses

- Lots of hardware to buy separately.
- One-piece wing can be difficult to transport.

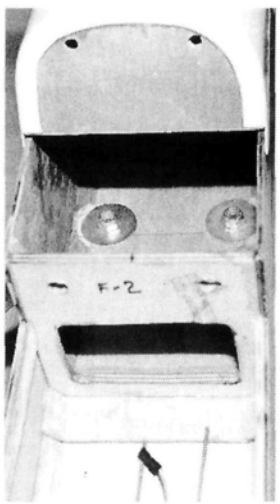
• **Wing.** The single-piece wing is built first; it's the component that required the most care and time. It can be built in either an 80½-inch-span or a 72-inch-span version. I opted for the larger span, which is legal for IMAA competition; the shorter span is not, but it gives a more aerobatic performance.

The wing-cores come with longitudinal slots cut in the top and bottom, into which you must glue heavy-duty hard-balsa spars. (White glue is recommended for this purpose.) The balsa leading and trailing edges are also attached with white glue. To install the plywood wing spars, you must saw a bit at the inboard ends of the wing panels. Band sawing is the best way to get true cuts at this joint, although with care, a hand saw will also do the trick.

Sheet balsa (3/32 inch) is applied with contact cement to the front and trailing edge, tops and bottoms, of the wing panels. The instructions say a new contact cement—Stay-Put II Spray Adhesive, made for Styrofoam—is also appropriate, and 3M77 is another alternative. (If you use either, be sure to wear a canister-air-filter mask and work in a well-ventilated area.) I chose to use Stay-Put; it comes in an aerosol can that has a nozzle that creates a handy fan-shaped spray. I like 3M77 just as well, however. I hope you have discovered its virtues in bonding fiberglass-cloth reinforcement to wood and plastic parts before sealing it down with thin CA adhesive. The bottoms of the foam wing-cores have to be carved out to accept aileron servos. I bent no. 14 copper wire to the required shape, then I inserted both ends into my soldering gun to make a hot-wire cutter. Using my cutter to scoop out these servo recesses, in a very few minutes, I had smooth, firm servo cavities.

Next came the most difficult operation of all: the creation of two, 22-inch-long, ½-inch-diameter tunnels running from each wing root outward to the aileron servo recesses (for routing the servo leads, of course). The manual does not suggest any way to cut, drill, or burn these holes in the foam-cores. I made a drilling jig that held the wing firmly in position while its guide holes steered my hand-operated drill.

To make the drill itself, I used two 12-inch lengths of ½-inch brass tube, which I sharpened at one end to make a cutting edge. I joined the two pieces of tube with a dowel plug to create a 24-inch-long hand-cutter. Rotating the cutter slowly, it took more than a few minutes to drill those two holes, but they're accurate, and I didn't remove too much foam. Feeding the servo leads and extensions through the holes was a snap. Before joining the two wing halves, the wingtips must be sanded square and flat, and ⅛-inch sheet balsa is added to give the foam a firm end plate. To simulate rib capstrips, add 3/32x3/8-inch balsa capstrips to the tops and bottoms of the two wing panels. These are applied to the foam surfaces with white glue. This makes the subsequent sanding step a lot easier. The capstrips



Fender washers secure the heavy-duty landing gear.

give an appearance of a built-up wing.

• **Tail group.** The stabilizer, elevators, fin and rudder are all made of built-up 3/8-inch-thick balsa sticks. There's also a bit of plywood reinforcing and some hardwood-dowel sections into which the elevator support wires are anchored. Drill the holes for Robart* Super Point no. 310 heavy-duty hinges (I've found that they work exceedingly well), and the tail-group assembly is nearly finished.

• **Fuselage.** The fuselage is a simple box structure made of die-cut sheet-balsa sides glued to bulkheads. Internal tri-stock wood reinforcements are used for rigidity and strength. At the wing saddles, doublers are used for further structural integrity. When the sides, bottom and front of the box have been glued up and sanded, the upper section of the fuse is still open. It's now time to line up all the pushrod sleeves and their intermediate anchors. I installed three intermediate stiffener plates for the pushrod sleeves and ran them to the tail feathers. Then I epoxied the stabilizer and fin. Use care to ensure the true alignment of these components.

• **ABS components.** Next fit the plastic turtle deck, cockpit and tank-cover segments into position, trimming these parts as necessary. You will also add internal fiberglass-cloth reinforcement to the ABS components as specified. The instructions advise you to permanently glue the turtle deck and tank cover to the fuselage sides. I

The author checks the pushrod installation.

Note the elevator support wires and the tail wheel. During low-throttle dives, these wires emit a very nice whistle.

FLIGHT PERFORMANCE

by DAVID C. BARON

For this review, the Lanier Stinger 120 was flown with two different power systems: an O.S. 1.08 running on methanol and, later, a diesel version of the same engine. The aircraft was also used as a test bed for other projects. At one point, its flight weight was as much as 17 pounds, but it was subsequently reduced to 14.3 pounds. Its advertised weight is in the 12+ -pound range, so we obviously seriously abused the plane's wing loading. On the other hand, it was interesting to test-fly it at different weights.

To be honest, this airplane, which was built with an IMAA-legal wingspan, is probably the friendliest, most docile and well-mannered plane I've ever reported on. Even in its most overweight configuration, it refused to exhibit even a tendency to perform badly. It was a rare treat.

• Takeoff and landing

The landing gear has a wonderful stance, and taxiing, even in strong crosswinds, was very comfortable. The first takeoff was uneventful; the plane very smoothly transitions to flight. At the highest weight noted, and powered by glow fuel, climbs were hardly rocket-like, but the plane *did* ascend at a very comfortable rate. With the diesel conversion, and at the lower weight, takeoffs had much more gusto, and its climb rate was much more lively.

Landings were always smooth and predictable. The plane tracks very well and shows no trim-change tendencies when the power is chopped. It does a side slip as well as a Piper Cub does, and it has a long, deep flare.

• High-speed performance

The model tracks well at all speeds, but at full throttle and flat and level, it tracks like a train; it loops and does pylon turns without showing any possibility of doing accelerated stalls.

• Low-speed performance

Even when dragging through the air behind the power curve, the Stinger 120 is stable. This airplane deserves to be called more than a trainer. It would certainly do that job easily, but it would never be put out to pasture afterward!

• Aerobatics

This airplane just begs to be wrung out. It flies knife-edge flight with almost no elevator or aileron compensation; it snaps and spins like a top; and it flies inverted as well as it does upright. Even when flown at its highest wing loading, it was still too much fun to resist doing a few low, low, low four-point rolls. Looping maneuvers at a high wing loading required serious energy management to keep it tracking "over the top," but at no time did it show a tendency to stall violently or to get overly mushy on the controls.

When its weight was down to 14.3 pounds, spinning an APC 15x11 prop, the diesel O.S. 1.08 pulled the plane noticeably faster than that engine powered by glow fuel and spinning a 15x8 prop had. It now had the constant air speed to do much larger aerobatics, and it never sagged on the vertical lines. (And the drone of the engine was more constant than when flying on glow fuel.) With the extra power boost that this modification allows, it was certainly more of a hot-dogger's dream.

• Diesel notes

If you see a larger-displacement diesel in action, you'll notice that it's much less noisy than a glow engine. If your field has noise restrictions, or if you just want to be able to hear yourself think while you fly, you might want to look into this wonderful alternative. You also gain power.

Let's look at both: the 1.08 was happy spinning a master Airscrew 15x8 at 9,000rpm on methanol, but it had no trouble spinning a Zinger 18x8 at 6,200rpm on diesel. To convert that extra power to observable increases in flight speed, we put a 15x11 APC on the diesel conversion. It spun that prop at 7,400rpm, and the sound was measured at 92dB—2dB quieter than the methanol setup (Soundmaster muffler used both times).

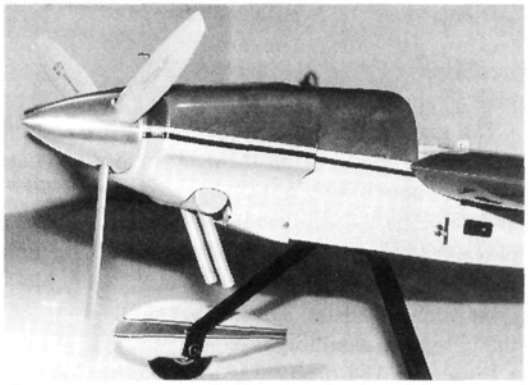
This isn't to say that diesel is the answer to everyone's prayers. It tends to be messy, and it requires the use of a cleaning solution with at least some alcohol in it to remove the carbonized oil residue left on the plane. Starting a diesel engine is also a bit different. You must keep track of another adjustment—compression. (A nut on the diesel head is used to adjust this. It sits where the glow plug usually does.) You also need some warm-up time before you start your takeoff run. Think of the rituals that we go through for our glow and gas engines; a diesel isn't any more of a burden—just different, with its own bag of tricks. A major advantage is that you can swing much larger props and enjoy far longer flights on the same quantity of fuel. That sparks my interest!

expected to modify the fuel system (for diesel), so I installed the tank cover with screws to make it removable.

POWERPLANT

It's now time to fit the engine of your choice (and its mount) on the firewall. With a standard 1.20 4-stroke, which is a relatively long engine, the motor mount would simply be put against the firewall.

The shorter O.S. 1.08 2-stroke requires an additional firewall about 5/8 inch in front of the basic one. This puts the thrust washer in the right position with respect to the cowl. With this 5/8-inch space between the primary and secondary firewalls, the installation of vibration-absorbing mounting screws and rubber inserts became super-simple. For the 1.08, I use Vibra Damp mounting hardware, which is supplied with a J'Tec* engine mount, and things worked out very nicely up front.



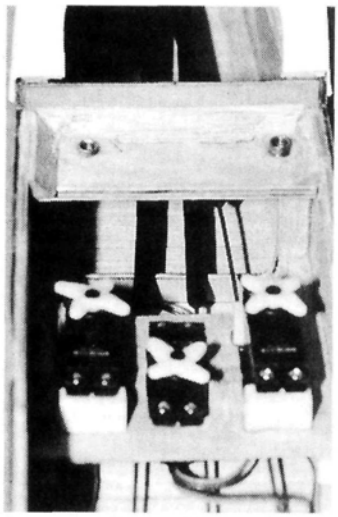
Here, the plane is shown with a Slimline muffler and a True Turn Ultimate-style spinner with slots for a three-blade Graupner* prop. This spinner is particularly sharp-looking.*

RADIO AND COVERING

Servos and radio gear were fitted in next, along with a 16-ounce Hayes* slimline fuel tank. Each elevator half has its own servo, and the rudder operates with only one. The throttle has one, and each aileron has one. In all, there are six servos, all standard-size JRs*.

I covered the Stinger with Coverite's* 21st Century fabric and was absolutely delighted with how easily it went on. It shrinks very predictably and bonds well to itself at overlapped seams. If you do a reasonably good job of sanding the plane's parts first, this material can make you look pretty much like a professional!

The plastic parts on the upper fuse can all be spray-painted before installation to get clear, sharp color-separation lines. I used Coverite's 21st Century spray paints; they're produced in colors to match the fabric. The dark red and yellow I selected contrast nicely with each other and are visible when airborne, too.



Servo installation; the outside servos activate the two elevators, and the center servo controls the rudder.

AT THE FLYING FIELD

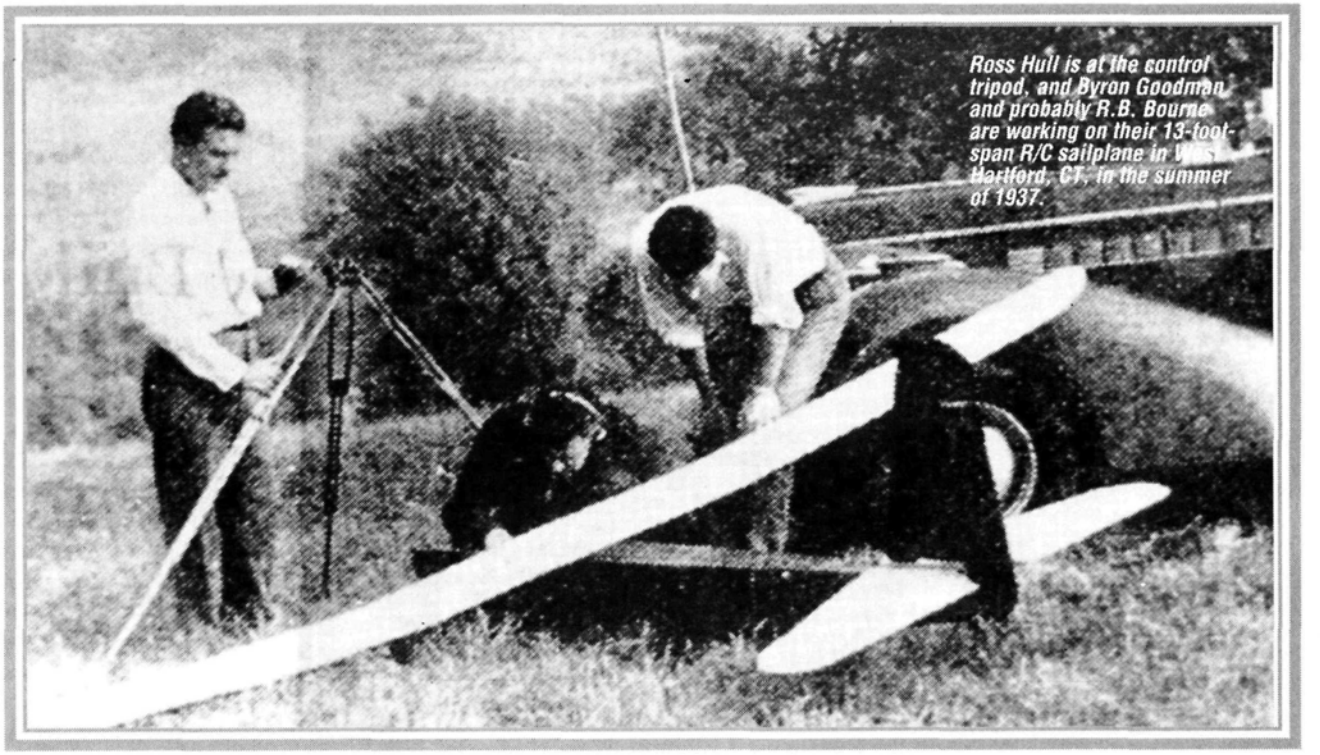
After the final installation of the radio gear, the setting of the control throws, and balancing, the Stinger was ready for its initial flight testing. Dave Baron, our club's chief test pilot, was recruited for the trial run.

The plane weighs 14.3 pounds. Compared with some other Stinger 120s I know of, mine is a couple of pounds overweight. On the other hand, I use the larger, heavier wing and fiberglass and epoxy wheel pants instead of the supplied ABS pants. And I *do* have a reputation for building really durable aircraft, and I *did* use a heavier covering material. We were therefore all interested to see how the plane and its O.S. 1.08 would perform.

I'm pleased to report that this is a terrific flier, although running on methanol, the engine is just slightly on the small side if you want spectacular vertical climbs into the stratosphere. If you want this type of performance, the Super Tigre 2500 would probably be a better choice. Great rolls, loops, spins, inverted flight, snap rolls and knife-edge flight were all accomplished with graceful precision by pilot Baron. The Stinger proved to be a true "aerobat" without any bad habits; it goes exactly where you point it.

Because the radio used is a computer type, setting up the aileron servos on two different channels made it possible to program in the flaperon function; on landings, this lets the ailerons do extra duty as partial flaps. The wing has such a generous area, however, that landing speeds need not be fast at all. Flaperons just put "icing on the cake."

(Continued on page 123)



Ross Hull is at the control tripod, and Byron Goodman, and probably R.B. Bourne are working on their 13-foot-span R/C sailplane in West Hartford, CT, in the summer of 1937.

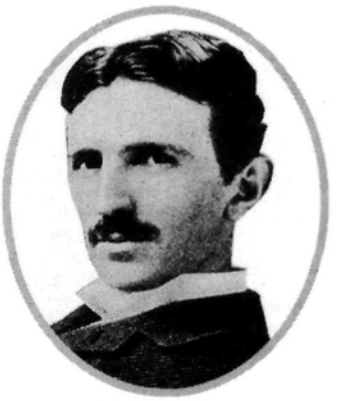
the first days of Radio Control

by FRANK GUDAITIS

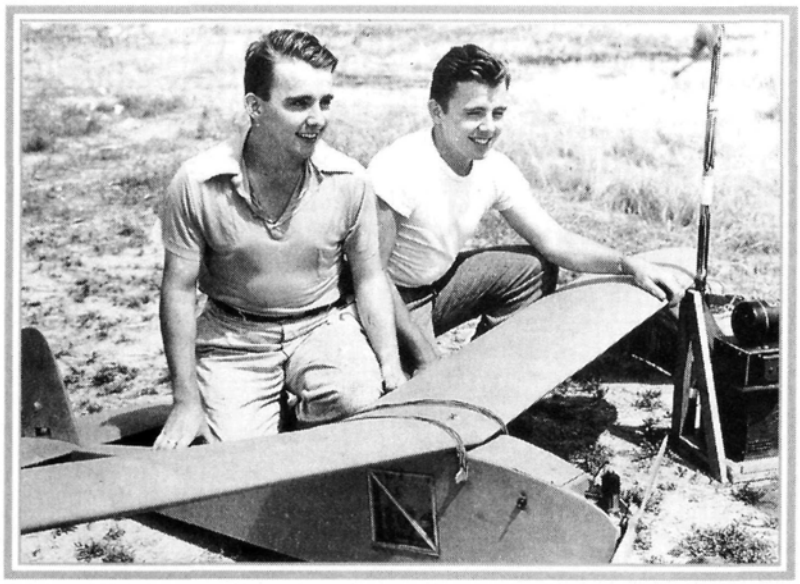
THE VERY FIRST example of radio control was demonstrated in New York City in 1898. Its inventor—Nikola Tesla—was a 43-year-old immigrant who was duly awarded U.S. Patent no. 613,809 on November 8, 1898. It was only one of 113 U.S. patents that this prolific genius received during his lifetime. Many electrical engineers and historians regard his basic inventions as the foundation of the 20th century as we know it.

In the decades that followed, the military and its suppliers attempted to implement Tesla's work in various R/C projects—including boats and aircraft—without very much fanfare.

By the middle of the 1930s, miniature airplanes were just beginning to be powered by very small gasoline engines. An R/C contest event was even scheduled for the 1936 model aircraft Nationals in Detroit. It was a little premature; not one entrant showed up! The following year must be regarded as the true beginning of R/C.



This is Nikola Tesla—the father of R/C and much of today's electronic technology.



Walt and Bill Good and their R/C model—the Guff (circa 1939).

R/C PIONEERS

Ross Hull and Clinton DeSoto—early R/C pioneers.

Several men who were active in amateur radio became interested in the possibility of controlling model planes by radio. Two of these early pioneers were Ross Hull and Clinton DeSoto. Both were officials of the American Radio Relay League (ARRL), which is the governing body of ham radio operators. Hull was a very gifted radio designer whose achievements include the discovery and eventual explanation of the tropospheric bending of VHF radio waves. Since his youth in Australia, Hull also happened to be an avid modeler.

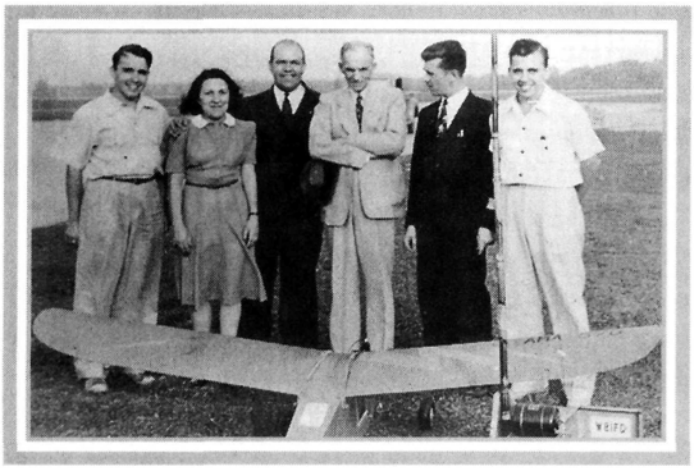
Hull and his associate DeSoto successfully built and flew several large R/C gliders in the first public demonstration of controlled flights. Their sailplanes made more than 100 flights. (See the January and August '38 issues of *Model Airplane News*). Tragically, Hull died one year later in 1939 when he accidentally contacted 6,000 volts while he was working on an early television receiver. DeSoto died a decade later.

COMPETITIVE FLIGHT

The 1937 Nationals R/C event attracted six entrants: Walter Good, Elmer Wasman, Chester Lanzo, Leo Weiss, Patrick Sweeney and B. Shiffman. Lanzo won with the lightest (6 pounds) and the simplest model plane, although his flight was a bit erratic and lasted only several minutes. Sweeney and Wasman both had extremely short (5-second) flights when their aircraft took off, climbed steeply, stalled and crashed. Sweeney, however, had the distinction of being the first person to attempt an R/C flight in a national contest. The other three entrants weren't able to make any flights at all.

BIRTH OF THE REED

One of them—Weiss—was an 18-year-old aeronautical engineering student who had constructed a very large, 14-foot-wingspan R/C model. He and an electrical engineering student—Jon Lopus—had devised a very sophisticated, innovative R/C system consisting of six tuned reeds that reacted to audio tones. The reed-control system became widely accepted in the 1950s. During the 1937 Nationals, however, Weiss wasn't able to start his plane's Ferguson twin-cylinder engine. He went on to successfully operate an avionics manufacturing company.



The Good brothers give a flight demonstration for Henry Ford Sr. (age 80) in 1940.

R/C EVOLVES

The 1938 Nationals were once again hosted by the "Motor City." Although the R/C entry list had grown to 26 entrants, only five fliers showed up on the field. One of the newcomers was DeSoto, who entered a 14-foot-wingspan, 25-pound, stand-off-scale model of a Piper Cub that was powered by a Forster twin-cylinder engine. Each of the four separate receivers on board used a gas-filled Raytheon RK-62 tube in a super regenerative circuit to activate its own sigma relay. His plane placed second, but it isn't clear whether or not it actually flew. Oddly enough, these first contests required only that contestants demonstrate their R/C systems in a static position on the ground to win a runner-up award.

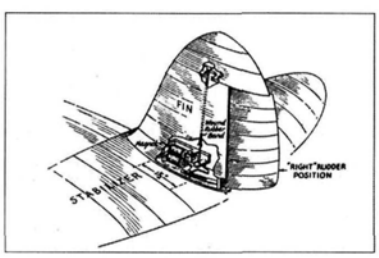
Walter Good was the only contestant who attempted a controlled flight in the face of the 20mph winds. Even though it ended in a crack-up, Walt was awarded first place. A truly convincing demonstration of R/C flight by a powered miniature aircraft would have to wait until the following year.

Eleven R/C fliers showed up at the 1939 Nationals at the Detroit Wayne County airport. For the first time, a 100-point system was adopted by the judges. Points were given for craftsmanship, actual R/C operation in a static preflight mode on the ground and a variety of flight maneuvers.

GOOD FLIERS

That was a rewarding year for Walter and William Good—23-year-old twins from Kalamazoo, MI. Bill was a licensed ham-radio operator with the call letters W81FD. Their aircraft—named K-G—was a slightly modified, high-wing monoplane. (See the K-G story in the January '91 issue of *Model Airplane News*.) This first stable gas model was designed by a former editor of *Model Airplane News*—Charles Hampson Grant.

Their radio and control mecha-



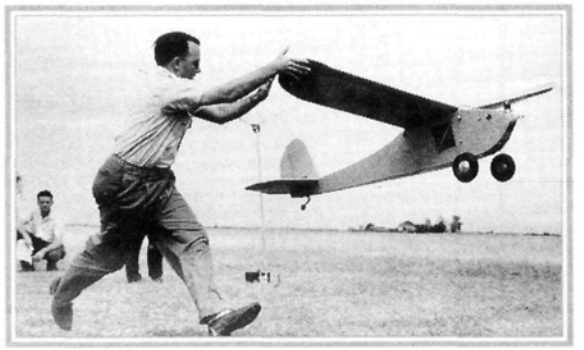
This is the rudder actuating control in the Good brother's model.

With the advent of the transistor and the integrated microcircuits, today's R/C builder hardly has any of the frustrations of the early pioneers.

nisms were the essence of simplicity. At a time when all of their competitor's planes carried receivers with 3- and 4-tube circuits, the Good brothers' radio receiver was a one-tube affair with a minimum of electrical components. Their homemade relay was so sensitive that it could be activated by a current change of ½ milliamp! They also designed and made their 1-ounce, rubber-band-powered escapement mechanism.

Before going to the Nationals in 1939, the two brothers had accumulated over 60 controlled flights in southern Michigan. Their diligent efforts paid off with a first-place score of 89 points; the second-place winner scored only 11 points. The Good brothers repeated their first-place win in the 1940 Nationals and once more after the end of WW II, in 1947.

Their historic R/C model airplane, which they affectionately named the "Guff," was presented to the National Air and Space Museum in Washington, D.C., in May, 1960, where it can be seen today. Both brothers continued their education and subsequently earned doctorates in physics. After pursuing careers in electronics research and teaching, they retired, but they're still very active in electronics. Walt lives in Florida, and Bill resides in upstate New York. They communicate constantly with each other using their ham radios.



Walter Good launches Guff at the 1947 Nationals. Bill is at the controls; his feet are behind Walt.

Here's Joe Raspante with his R/C Super Buccaneer at the NY Mirror Meet. Note the car trunk that's full of transmitter equipment (circa 1946).

JOSEPH RASPANTE

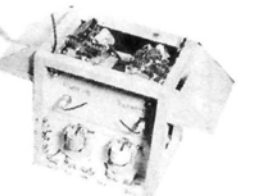
No story on the early days of R/C would be complete without recognizing the work of Joseph Raspante. Unlike most of the early pioneers of R/C, who were basically model airplane builders teamed up with ham-radio specialists, Joe Raspante was a superb designer and builder of early gas models as well as a competent electronic technician. His R/C system was unique in that he used a telephone dial to select various control functions. He placed second in the 1939 R/C Nationals and third in the 1940 event.

Raspante was generous, and he shared his knowledge with young builders in years that followed.

In Walt's shop in Florida, the 75-year-old Good twins work on a spectrum analyzer that was built by Bill.

Walter Good remembers that when thieves stole his brother's R/C transmitter from their hotel the day before the 1940 Nationals, Raspante offered the use of his own transmitter. This gesture was especially meaningful, because the Good brothers had defeated him in the 1939 Nationals. Raspante finally won the first place he yearned for at the 1946 NY Daily Mirror contest at Grumman airfield. It was my privilege to see him fly there.

With the advent of the transistor and the integrated microcircuits, today's R/C builder hardly has any of the frustrations of the early pioneers. In retrospect, however, we see that most of the pioneer's dedicated efforts were largely foiled by overly complex electrical designs.



The balsa frame that holds Guff's receivers—one for the rudder and one for the elevator—is 6 inches high. Its total weight is 14 ounces (less batteries).

Joe Raspante launches his R/C model at the 1946 NY Mirror Meet at Grumman Airport in Long Island, NY.

But without their perseverance, I doubt that R/C flight would have progressed as quickly to where it is today. ■

MODEL AIRPLANE NEWS
FIELD & BENCH REVIEW

Kalt ENFORCER ZR

BY MIKE CINGARI

THE .30-SIZE HELICOPTER has become the most popular machine for entry-level pilots. Because the market is so competitive, manufacturers try to keep the prices of these machines low, while providing us with good performance, durability and reliability. Distributed by Horizon Hobby Distributors*, the Enforcer ZR is Kalt's latest .30 heli. Compared with the original Enforcer, it offers big improvements in flight characteristics and reliability.

DESIGN IMPROVEMENTS

There are over a dozen improvements that make the ZR an economical, high-performance machine. Following the current trend in .30 helicopters, the ZR has an increased main-rotor span (the most noticeable difference between it and the original Enforcer). By increasing the rotor span to 49½ inches (the rotor disk area was increased by 3 inches), Kalt ensures that the machine has more stability in hover, better aerobatic performance and more rotor-blade inertia for excellent autorotation performance. To accommodate the broader rotor span, the tail boom has been stretched 1½ inches; the tail-rotor drive-wire diameter has also been increased to 2mm to help eliminate tail-drive-wire whip.

The kit comes with balanced, 530mm, KSJ rotor blades that are covered in a clear heat-shrink wrap and have swept tips to reduce blade drag. They are made of four plys of wood and are weighted at the tip. To complete the blades, attach the plastic blade roots and do the final balancing.

To check the blades' balance, I used the new Revolution blade balancer, available from Horizon. This device operates on the see-saw principle and indicates rotor-blade weight differences with a bubble that's inside a viewing tube. I bolted the rotor blades to the balancer and placed it on two drinking glasses of equal height. To center the balancer's bubble, I had to add some tracking tape to one of the blades. My blades came to a finished weight of 105 grams.

The flybar is equipped with the new KSJ flybar paddles. These paddles, along with the KSJ rotor blades, give the ZR the ability to

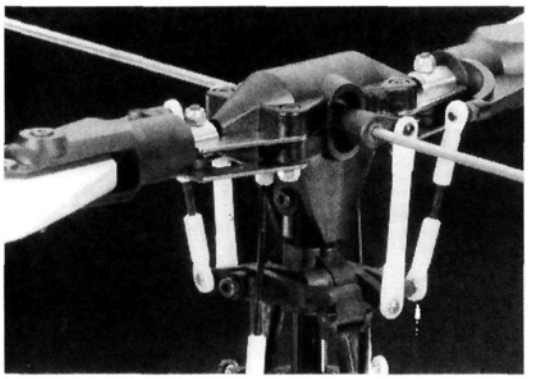
Photos by Mike Cingari

fly with no increase in pitch sensitivity in fast, forward flight. The ZR has 25 degrees of pitch travel available and ample cyclic control to satisfy the needs of both novice and hot-dog, expert pilots.

Moving on to the rotor head, you will notice that the rotor blade grips have been molded in one piece. They're even more massive than those on the original Enforcer and will accept 12mm blade roots. These improvements give the rotor head more strength and rigidity, which are necessary for high-rpm, hot-dog flying. An additional set of trimmed flex plates, "boom-strike stoppers," were added to the bottom of the rotor head. They help to prevent boom strikes by limiting the downward flapping of the main rotor blades. Socket-head cap screws are used throughout the rotor head; they're stronger than the original Enforcer's Phillips-head screws.

POWER TRAIN

I use the new Webra* .32 Redhead engine to power my ZR. This latest version has a 7.5mm carburetor bore that allows the Redhead to produce 1,000rpm more than the original .32. The extra power, combined with the larger rotor span, makes the ZR perform aerobatics very well, yet it's still docile enough for novices. To quiet the Webra .32, I use the Kalt Enforcer ZR muffler—a one-piece design that is bolted directly to the Webra .32 engine and directs the exhaust away from the side frames and out toward the rear of the helicopter.



One-piece, 12mm blade grips, an additional flex plate, socket-head cap screws and metal balls make up the ZR's refined rotor head.

The Enforcer's engine uses a conventional starter. This eliminates the need to purchase an additional starter shaft, which is required on some of the helicopters in this class. The light plastic starter cone has an aluminum cap and is mounted to the new nylon cooling fan.

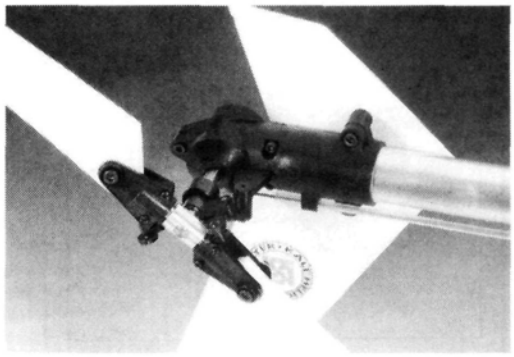
Kalt also improved the ZR's transmission. To limit main-shaft end play, two additional collars at the top and bottom of the transmission case have been added to the shaft. The transmission housing has been re-molded to accept the two ball bearings that accommodate the new shaft collars. The new main gear is molded out of nylon and has an improved tooth pattern that will increase the performance and reliability of the drive train. And the clutch bell is a work of art! It's machined out of aluminum, has the clutch liner already installed and has two large ball bearings. With the new metal clutch, this drive train will probably last a long time. The kit includes three different bushings for the clutch-drive gear bearing, so I chose the one that fit the Webra .32 Redhead and installed it in my engine.

CONTROL SYSTEM

Metal-link balls are now standard on the swashplate and on many of the ZR's control levers. They are molded directly into the plastic and are identifiable by the "flat ends" of the balls. Metal balls, which are usually options on other machines in this class, help the ZR to maintain a very tight control system. They increase the control system's precision, shorten its response time and keep the ball links tighter for a longer time.

The Enforcer ZR has 36 ball bearings. They increase its precision by reducing friction and ensuring that all the pivot points remain tight. Ball bearings decrease the need for maintenance and make the Enforcer ZR much more durable. The roll, pitch and tail-rotor levers have brass bushings, but they seem to pivot smoothly and are slop-free.

One of the ZR's unique features is its modular design. Its major components are composed of separate modules; the servo/radio, engine/clutch, transmission, side-frames/landing-gear, and tail-assembly modules make up the completed machine. Each module can be removed individually to facilitate maintenance and repair. Kalt has also added threaded-brass inserts to the frame cross-members; these inserts greatly improve the strength of the main frames and allow the use of socket-head cap screws in place of the old Enforcer's Phillips-head screws, which were prone to stripping out.



The ZR's precise, high-quality tail-rotor assembly gives the ZR excellent tail-rotor response.

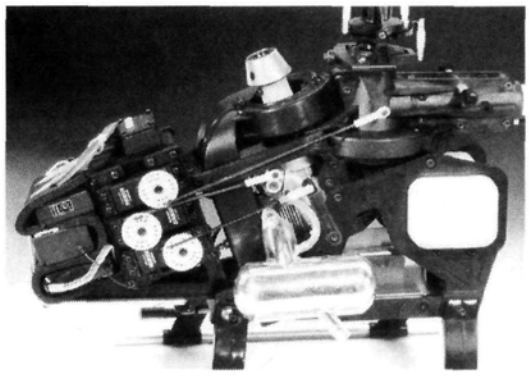
THE GOOD BOOK

The kit's instruction book is its best feature. The tools, parts and other items needed to complete each step are well-described in text and diagrams. This book, along with the exploded drawing of the ZR, made assembling this machine very quick and easy to do. It gives you pre-construction advice and describes the setting up and programming of the ZR with a computer radio. This is by far the best set of instructions that I have ever used to build an R/C helicopter. Modelers with minimal experience will have no trouble building and setting up the Enforcer ZR.

Kalt also offers an Enforcer ZR upgrade kit that includes all of the items mentioned here that are needed to upgrade your old Enforcer to ZR specifications. This kit, which comes with the new color graphics, will give your old Enforcer an entirely new look and will greatly improve its flight performance.

FLIGHT PERFORMANCE

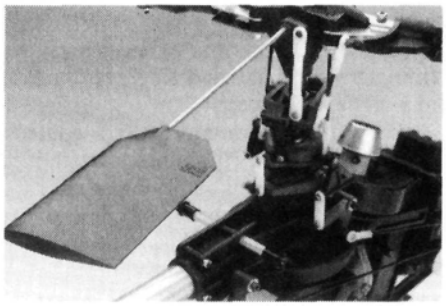
My ZR's first flight took place on a breezy Texas day, and that made it interesting for a new helicopter and engine, to say the least. After making minor mixture and tracking adjustments, I took the Enforcer ZR into forward flight, then I



From the servos to the levers, radio installation and control-system hookup is simple and direct.

SPECIFICATIONS

Main rotor diameter: 49.5 in.
Tail rotor diameter: 8.25 in.
Overall length: 42.5 in.
Weight: 6 lb.
Gear ratio, engine to main: 9.8:1
Gear ratio, main to tail: 1:4.9
Engine size: .28 to .35
Radio: 5-channel heli, 5 servos
Price: $499.95



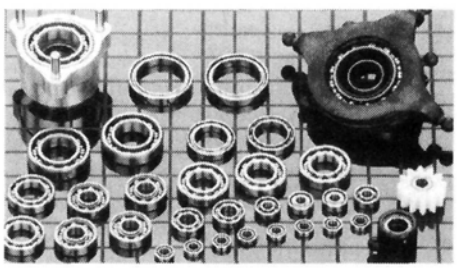
KSJ flybar paddles enhance forward-flight characteristics by eliminating high-speed pitching and improving aerobatic performance.

made some small programming changes and began to explore its flight characteristics.

I noticed a slight low-frequency vibration in the tail boom. Because the tail boom is quite long and unsupported, I installed a tail-boom brace on my ZR. Now it runs very smoothly and is vibration-free.

The ZR's overall flight performance is excellent. It's very stable in a hover and has a soft feel owing to the blades' ability to flap independently. This is a flight characteristic that pilots of all skill levels will appreciate. It allows beginners to learn at a faster rate and allows experienced pilots to control the ZR precisely during hovering maneuvers. Tail-rotor response and power are well above average for a .30 machine.

The Enforcer's autorotation performance is also very good for a .30. I began to shoot repetitive autos and found that there was adequate rotor-blade inertia for a short hover just before touchdown. The ZR is a great helicopter to use to learn autorotation landings. If you're flying around and don't



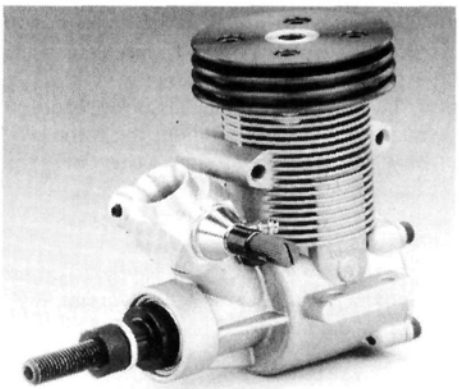
The Enforcer ZR includes 36 ball bearings—throughout the helicopter—for a tight, long-lasting machine.

know how to auto, you've missed a very important and enjoyable skill that's required to fly your R/C helicopter successfully.

Start learning autos close to the ground and work your way up. Make your "normal" and "hold" pitch curves match, and while in a low hover, hit the "hold" and land. When you've worked your way up to a 5-foot auto, it's time to connect an approach to the flare and go for it! It's as simple as that! I'm a firm believer that every landing should be an auto. This will allow you to develop the technique and know that it will pay off someday—when your engine quits in flight and you are *forced* to auto.

Upstairs, the ZR has excellent cyclic power for any maneuver you care to try. Although the Enforcer ZR lacks the inertia to perform large loops and long slow rolls, it has plenty of control authority to perform hovering rolls and flips. In forward flight, the new blades and flybar paddles make the ZR track like a 60. Throughout its entire speed range, it exhibits solid handling characteristics in gusty wind conditions.

The ZR flies inverted just as well as it does upright. I have my collective rod 13mm out from the center of the servo



With its large 7.5mm carb and distinctive, red cylinder head, the Webra .32 Redhead is the most powerful .30 engine I've ever flown.

wheel and have 19 degrees of pitch available. This allows me to have a range of from +10 degrees in my hold curve to -9 degrees for low-stick in flight-mode 2.

I run my rotor head at 1,800rpm, which allows the Webra .32 Redhead to produce the optimum power required for high-rate aerobatics; this suits my flying style. To handle this type of setup smoothly, be sure to use about 20 percent exponential and 100 percent servo travel on the cyclic controls. This will allow you the luxury of having a responsive—yet smooth—machine without your having to flip switches to obtain different control rates.

The Enforcer ZR is stable and agile, and certainly one of the top-drawer .30 helicopters available today. It's a high-quality, well-designed, low-cost, reliable .30 machine that offers beginners and experts many desirable features. Without compromising the features that novices require to be successful in learning to fly R/C helicopters, Kalt has done a fine job of producing a machine that also satisfies the needs of expert pilots.

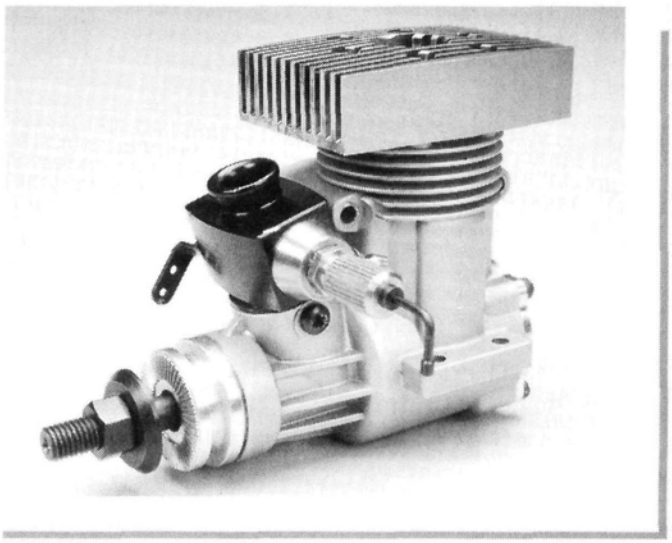
I really like the Enforcer ZR. It's a sleek-looking machine with performance to match; it's an excellent choice of a .30 size helicopter.

**Here are the addresses of the companies mentioned in this article:*
Horizon Hobby Distributors; *P.O. Box 3726, Champaign, IL 61826.*
Webra; *distributed by Horizon Hobby Distributors (address above).* ■

ROTARY-WING ROUNDUP

NEW HELI PRODUCTS

GREAT PLANES
Irvine .36 Heli Engine

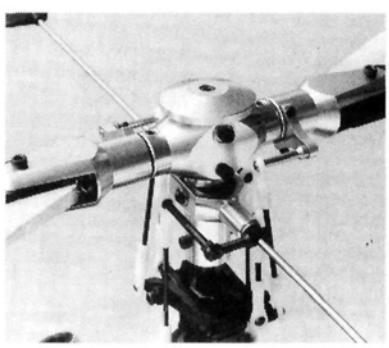


This new Irvine .36 heli engine has true ABC construction, a machined backplate and a double-ball-bearing-supported crankshaft. It offers fast, easy starting; smooth idling; and enough power for demanding aerobatics. Its sealed front bearing ensures smooth, clean, reliable running. Designed for high power, durability and longevity, the .36 heli engine has the same mounting dimensions, bolt pattern and exhaust configuration as the O.S. .32 F-H, so it can easily be installed in the Concept 30 and other .30 models. A muffler isn't included. Specifications: displacement—.36ci; bore—.81 inch; stroke—.71 inch; power—1.1b.hp/21,000rpm; carburetor—machined, anodized, two-needle Jetstream series; piston/liner—ABC.
Part no.—IRVG0230; **price**—$219.99.
Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61826-9021; (217) 398-6300.

PACER TECHNOLOGY
Blade Zap

Blade Zap is a new, high-tech CA that's formulated specifically for attaching weights and fittings to helicopter blades. Blade Zap offers six times the strength needed for these applications, and it cures in 30 to 90 seconds without the aid of a kicker. (The regional sales offices for Blade Zap are: House of Balsa, 10101 Yucca Rd., Adelanto, CA 92301; Robart Mfg., P.O. Box 1247, St. Charles, IL 60174; Frank Tiano Enterprises, 15300 Estancia Ln., West Palm Beach, FL 33414.)
Part no.—Pt-26; **price**—$4.99 per ½ oz.
Pacer Technology, 9420 Santa Anita Ave., Rancho Cucamonga, CA 91730.

KALT
S-30 Metal Head



This new S-30 metal rotor head greatly improves the responsiveness and aerobatic ability of the Kalt Enforcer and the Enforcer ZR. Machined of aircraft-grade aluminum, clear-anodized and with full ball bearings, the S-30 has a single underslung damper and a rigid, see-saw design that pivots on dual ball bearings. The S-30 head tracks solidly in forward flight without pitching. The S-30 makes all high-cyclic-rate hot-dogging aerobatics—tumbles, loop flips and roll flips—tighter, quicker and more dramatic.
Part no.—KLT32017; **price**—$259.95.
Kalt; distributed by Horizon Hobby Distributors, 4105 Fieldstone Rd., Champaign, IL 61821; (217) 355-9511.

Descriptions of new products appearing on this page were derived from press releases supplied by the manufacturers and/or their advertising agencies. The information given here does not constitute an endorsement by **Model Airplane News**, nor does it guarantee product performance or safety.

SPORTY SCALE TECHNIQUES

FRANK TIANO

OLD AND NEW MODELING TREASURES

THIS MONTH, I touch on some technical procedures, and next month, you're in for a real treat: full coverage of one of the best non-competitive scale events in the country. But that's next month; this month is different.

Some of the most frequently asked questions are about landing gear—you know: the do's and don'ts, ups and downs, etc. High on the list is a concern for having strength while maintaining a scale appearance. This goes for retractable landing gear and fixed gear. Well, to tell you the truth, there are some real guidelines concerning the installation of landing gear.

Stephan Dürrstein's DC-3 has intricate, light, soldered struts (a very strong structure—like a bridge!).

GEARED UP TO LOOK GOOD!

• **Fixed gear.** The heart of a strong landing-gear system is not the wire or strut itself. First, you must have a strong mounting plate to hold those struts. The mounting plate is usually constructed of a hardwood such as maple, or a good-quality, aircraft-grade five-ply birch plywood. To maximize the shock-absorbing qualities of the mount, it's most important that the landing loads and stresses be well-distributed over a large area. Too much pressure on too small a landing-gear plate and you're looking at severe breakage, dude!

The easiest and strongest way to mount gear on the fuselage is to mount the gear legs in tubes that are fastened to a bulkhead made of at least ¼-inch plywood, or for heavier models, even a ⅜-inch laminate of two pieces of 3/16-inch plywood.

If the gear is in the wing, the ribs that will hold the landing-gear mount should be made of plywood that's at least 1/8 inch thick for their entire length. Yes, you can make a balsa rib and line it with plywood, but *under no circumstances* should you use anything but aircraft-grade plywood—no light plywoods here!

Gear that has wheel pants will usually accept an additional V-brace to help prevent the gear from "kinking" during a bad landing or a hard one. Those that have a simple tubular strut will find that a fixed gear mount is available from Robart* and Byron*; just follow their assembly instructions (see Figure 1).

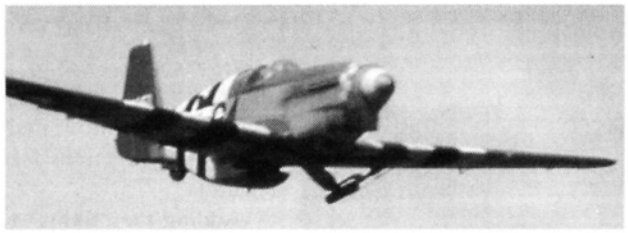
Adding the "fixins" to landing gear can make all the difference in the world when it comes to realism. You can simulate brake lines with bits of colored plastic-coated wire, and brake drums with a disk of fiberglass sheet.

Choosing a wheel that looks right is important, too. Try to stay away from a tire/wheel combo that looks too "toyish." Plain wire struts may be encapsulated in teardrop-shaped tubing such as that offered by K&S*. Fairings can be added to a wire substructure with fiberglass cloth or strips of Coverite*. They're only along for the ride, so they don't have to be bulletproof. Wheel collars can be concealed by a hubcap that's made of plastic sheet; or, in some installations, a bolt may be used for the axle, thus eliminating the use of collars altogether.

The gear on Art Johnson's P-35 retract rearward. The wheels are exposed from the wheel wells, and there aren't any inner doors to fuss with. The effect on CG is substantial.

• **Retracting gear.** The same general principles apply, but the bearers are enlarged a little. We've found that extending the gear mounts one wing rib bay inboard increases the structure's life (see Figure 2). Once again, the ribs should be plywood along their entire length. Never cut a wing spar to install retracting gear unless a secondary spar has been installed parallel to the first one before cutting.

Tom Polapink's Sopwith Snipe features exact-scale gear with minimal shock-absorbency. The mounts must be rugged—to say the least!



Great-looking Mustang; poor-scoring gear sequence! Brian O'Meara's problem is caused by a leaking air valve and air cylinder. A sagging gear affects the realism of all maneuvers.

Lining the wheel-well area with vertical-grain balsa or 1/32-inch plywood is also a great idea. Always fit your gear doors to the gear while the gear is retracted and the wing is upright. This loads the door against the skin for a much tighter fit. Too many times, modelers fasten the doors while the wing is upside-down on the bench, only to find a 1/8-inch gap when the wing is rolled upright and the gear is allowed to relax against the uplocks.

Always be certain that the gear will go into or out of "lock" with little effort. If the gear works too hard to get into or out of lock, you're just asking for trouble. A hung-up gear can destroy a model. Actually, it's not the one that hangs up, it's the other one—the one that's extended—that causes the damage when you try a one-wheel landing, especially on grass. Usually, the extended gear will cause a ground loop and bend rearward in the process, sometimes folding altogether and doing considerable damage to the bottom of the wing. Sometimes, a belly landing will cause far less damage.

So, making a functional gear is important, and making it look realistic has some value, too. And we mustn't forget the actual fit of the gear doors when the gear is retracted. In competition, judges look at gear-door fit as part of your total maneuver score, so it's important that the fit looks good from at least 5 or 6 feet away.

Without a doubt, the best way to make your doors fit properly is to mold them from the bottom wing skin before you cut the wheel wells.

Periodically check your gear for leaks or linkage changes to ensure proper sequencing at all times. There ain't nothin' worse than making a beautiful takeoff and then following it up with a hung up gear leg—*very* unprofessional.

David Toyer chose to build a Meteor turboprop. The simple gear doors fit flush and earn high scores.

Claude McCullough's Rauden shows another fixed-gear arrangement that looks fragile but is beefed up with supporting struts.

GASSIN' WITH FRANK

Another topic I'd like to touch on this month is engine performance. Now, I'm not talking about hopping up your favorite motor, but rather what you can do to ensure that you get the proper, designed, operating performance. Now comes the bomb! Would you believe that maybe 85 out of 100 engine-running problems (or *absence of* running!) are directly related to one thing? That's right; *one thing* can make that engine run erratically, over-rev, under-rev, spit and cough, run too hot and, in general, be a rather large pain in the posterior.

You know what that one very important thing is? Do ya? Huh? Well, it's all got to do with forgetting to put the prop on the motor! (nah, just kidding). What it really all boils down to is the fuel! Honest! Many of us fail to read an engine manufacturer's directions regarding the type of fuel we should use. And, usually, they're pretty specific about nitro content and, even more important, oil content.

So here's some general information.

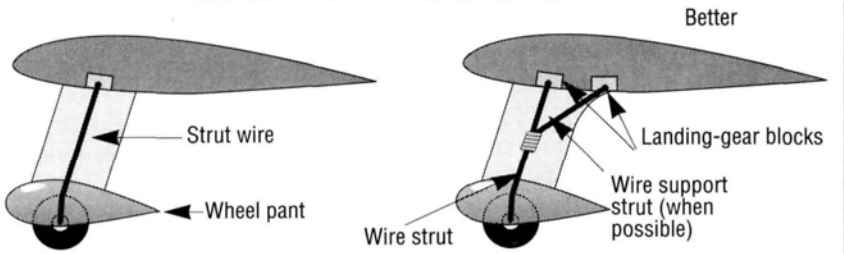
• Most, but not all, large engines of over 1½ci require less oil than your average sport engine. For example, the Super Tigre* 2500, 3000 and 4500 all call for 10 to 12 percent oil, while the Webra* Bully calls for a max of only 5 percent. Some of us go wrong when we buy a fuel labeled for Super Tigres and try using it in Super Tigre .40 to .90 engines. As Byron does, all manufacturers should say when a fuel is for big-block versions only. Using too much oil in the big Tigres will make them run too warm! Believe it or not!

• Many fuel manufacturers offer 4-stroke fuel containing 15 percent nitro and approximately 15 to 17 percent oil. We now find that this oil percentage might be wrong. Most 4-strokes seem to run far cooler with a *minimum of 18 percent* oil!

If you're having trouble, just remember that 1¼ ounce of oil added to your gallon of fuel will increase the oil content by 1 percent.

• As for the synthetic oil versus castor oil controversy, all I can do is give my opinion. But, first, a couple of facts. Castor oil

FIGURE 1 SIDE VIEW OF RIB



is far messier to clean up than synthetic oil. That's a fact. Synthetic oil does not protect your engine from corrosion (caused by moisture) as well as castor oil does. And that's a fact! Test-run an engine with castor oil and then with the same percentage of synthetic oil. Carefully put your hand near the exhaust outlet during both tests, and you know what you'll find? The test using castor oil will produce a much higher temperature at the exhaust outlet. In other words, the castor is removing a lot more heat from that engine than synthetic can ever think of doing. And that's a fact!

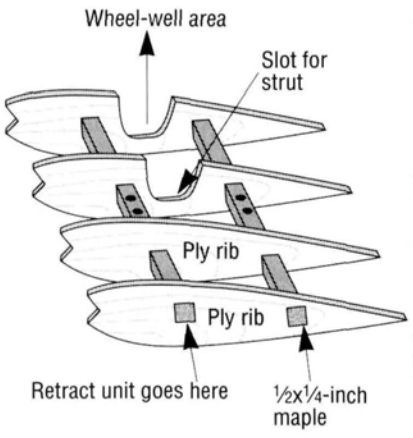


FIGURE 2 RIB

So, what does Frankie T. recommend? I like a 50:50 blend of both oils. When Red Max* makes my fuel, they always ask which formula I want. I always tell them the percentage of nitro followed by the percentage of oil, split 50:50 between their best castor and their best synthetic. I've never had a problem with fuel blended in this way. And I've actually solved several engine-running problems by adding a slug or two of Sig's* castor oil to many a modeler's regular old sport fuel!

In a nutshell: just follow the directions that come with your engine. Don't over-prop it, and don't under-oil it. And you'll be just fine.

AND LOOK OUT FOR...

As I said, the next issue will have comprehensive coverage of the Rally of Eagles, which was held in North Florida in October. Also, don't forget that Top Gun is on for April 28 through May 1 at Palm Beach Polo. And look for a great new fly-in at the Polo's practice fields over the Memorial Day weekend.

Palm Beach Polo has invited Frank Tiano Enterprises* (FTE) and the Palm Beach Aero Club to host yet another scale-model extravaganza some time after Top Gun. They'll give us four practice fields (all together) for one of the most fantastic flying sites you could ever hope to lay your eyes on. This event will simply be called "Wings." It will follow an IMAA format, i.e., only large scale models allowed—military and civilian; prop jobs or jets; but no non-scale models of any kind.

Wings will take flight on May 28 and 29, with Friday, May 27, reserved for practice and "site-orientation" flights. The Palm Beach Aero Club will provide a minimum of four and, possibly, as many as six flight lines. FTE and several sponsors will provide some major bucks, prizes

(Continued on page 123)

ROBBE ASH 26-E

(Continued from page 49)

ensured straight, true flight without the need for down-trim. *[Editor's note: Robbe notes that Mr. Quabeck, developer of the airfoil, set the tailplane incidence so that there would be no nose down or nose up pitching when the flaps are deployed. The ballooning effect can be avoided by setting aileron differential to at least 3 to 1. For tight circles, the outside aileron (i.e., the one pointing to the outside of the circle) should have zero degrees deflection.]*

We spent the rest of the afternoon flying and making final trim adjustments until we were both satisfied with the flight performance. John said the flying characteristics were, "Very nice."

I made one more correction to make my sailplane perform optimally. To stop the slight lateral movement on the fuselage wing roots, i.e., in the yaw axis, I installed a retainer spring between the two wing roots, about 2 1/2 inches from the trailing edge. This dramatically improved the precision of the ASH 26-E's flight, so I think the manufacturer should include this simple wing-retainer spring setup in future kits.

I needed some in-flight photos, so I again called on John for his flying expertise. He immediately acknowledged the improvement and was able to thermal in some of the lightest lift in the area, with the utmost precision, and enjoy some spectacular, out-of-sight flights. I thought we'd run out of battery time before I ran out of film. This time, John's comment on the flying characteristics was, *"Great!"*

AERO-TOWING

Although you can get some fantastic flights on a strong winch launch, for consistent optimum performance with a 14 1/2-foot sailplane, aero-towing is the way to go. On a towline, I've reached altitudes of close to 2,000 feet, and that allows me a minimum of 15 minutes in no-lift conditions and an average of 45 to 90 minutes in good lift. Unlike winch-launching, a towline doesn't stress the wings, and there's almost no danger of the line breaking.

I entered the ASH-26E in the '93 WRAMS Show, and it made an impressive showing because of its huge size and beautiful aerodynamic design. It impressed the judges so much that they awarded me first place in the sailplane competition. (I won a radio.)

Robbe's ASH-26E isn't for everyone, but neither is the Ferrari Testarossa. Although its price is a little steep, its performance and quality are exceptional. So, as the saying goes, "You get what you pay for," and this plane is definitely worth its price.

**Here are the addresses of the companies mentioned in this article:*

Robbe Model Sport, *170 Township Line Rd., Belle Mead, NJ 08502.*

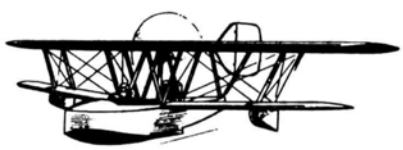
Airtronics Inc., *11 Autry, Irvine, CA 92718.*

Robart Mfg., *P.O. Box 1247, 625 N. 12th St., St. Charles, IL 60174.*

Hobby Lobby Intl., *5614 Franklin Pike Cir., Brentwood, TN 37027.*

Balsa USA, *P.O. Box 164, Marinette, WI 54143.*

Coverite, *420 Babylon Rd., Horsham, PA 19044.* ■



LANIER STINGER

(Continued from page 72)

So far, this has turned out to be a very happy project. If you're thinking of a larger plane for sport and general aerobatic flying, you'll really love the Stinger 120.

**Here are the addresses of the companies mentioned in this article:*
Lanier R/C, *P.O. Box 458, Oakwood Rd., Oakwood, GA 30566.*
O.S./Great Planes Model Distributors, *P.O. Box 9021, Champaign, IL 61826.*
Slimline Mfg., *P.O. Box 3295, Scottsdale, AZ 85257.*
Davis Diesel Development, *Box 141, Milford, CT 06460.*
Robart Mfg., *P. O. Box 1247, 625 N. 12th St., St. Charles, IL 60174.*
J'Tec, *164 School St., Daly City, CA 94014.*
Hayes Products, *2610 Croddy Way, Unit A, Santa Ana, CA 92704.*
JR Designs, *1225 N. Lance Ln., Anaheim, CA 92806.*
APC; *distributed by Landing Products, P.O. Box 938, Knights Landing, CA 95645.*
Coverite, *420 Babylon Rd., Horsham, PA 19044.*
True Turn Racing Products, *3333 Harrison Ave. #5, Riverside, CA 92503.*
Graupner; *distributed by Hobby Lobby Intl., 5614 Franklin Pike Cir., Brentwood, TN 37027.*
Master Airscrew; *distributed by Windsor Propeller Co., 3219 Monier Cir., Rancho Cordova, CA 95742.*
Zinger; *distributed by J&Z Products, 25029 S. Vermont Ave., Harbor City, CA 90710.* ■

SPORTY SCALE

(Continued from page 119)

and special awards. There will be a great informal cocktail party and a dinner.

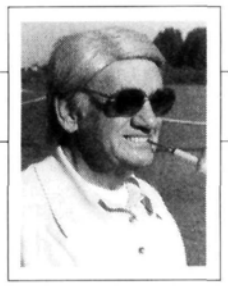
If you like Florida in springtime and you like to fly (or maybe want to show off your latest large-scale project), join us at one of the best fields in the entire world. The pre-registration fee is $15 per pilot ($20 if you wait until you're at the field). There's no limit to the number of airplanes! Contact me at FTE, or send an SASE for more details.

Until next time, have a great and safe holiday season. And do your part to boost the economy: go buy something at the hobby shop; you deserve it! Your six is clear.

**Here are the addresses that are pertinent to this article:*
Robart Mfg., *P.O. Box 1247, 625 N. 12th St., St. Charles, IL 60174.*
Byron Originals, *P.O. Box 279, Ida Grove, IA 51445.*
K&S Engineering, *6917 W. 59th St., Chicago, IL 60638.*
Coverite, *420 Babylon Rd., Horsham, PA 19044.*
Super Tigre/Great Planes Model Distributors, *P.O. Box 9021, Champaign, IL 61826.*

(Continued on page 150)

GOLDEN AGE OF R/C

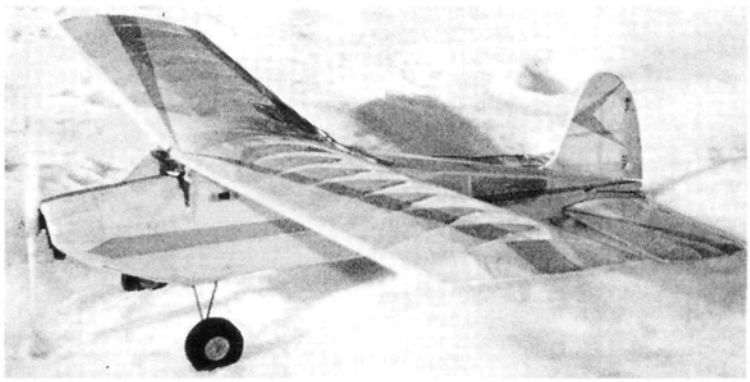


HAL DeBOLT

REBEL WITH A CAUSE

HERE'S A COOL story to match winter temperatures—how about recording an R/C flight at the *coldest* possible temperature?

One winter, Wesley Pipe of Beaverlodge, Alberta, Canada, went to work in northern Canada, near Ross River. (I should say that the coldest temperature in Canada was recorded there.) Impressed by Maynard Hill's records, Wesley thought that circumstances might allow him to establish one that not even Maynard would want. Perhaps he could fly in a colder temperature than anyone else.



Burl Anderson's electric-powered Live Wire Rebel—his latest of many. It's a good match for his engine-powered versions. The Rebel is from the '50s.

So, with his work gear, Wesley packed a Goldberg ½A Skylane, a Cox 049, a pint of fuel and an O.S. "Pixie" single-channel radio. At the barracks, while he waited for the cold weather, he built the Skylane. When it was time to cover it, alarm set in; he had forgotten to bring dope! If he waited for some to be sent to him, he'd miss the coldest weather. Improvisation to the rescue: he sprayed the silkspan with auto paint!

After the Skylane had been assembled and successfully tested-glided, Wesley sat back and waited for the temperature to drop. The current -40 degrees Fahrenheit wasn't low enough; the guys in Alaska could easily match that! Finally, the temperature dropped to -70 degrees Fahrenheit. That would be frigid enough; it was time!

The temperature in the barracks was a pleasant 70 degrees Fahrenheit, and the Cox easily screeched its siren song. With a positive radio check, the Skylane was launched through the barracks door. After an initial dip, it climbed merrily. When it reached about 75 feet, there was an explosion like that from a shotgun, and the model fell like a dead duck. Wesley was surprised, yes, but the goal had been accomplished; an R/C plane had been flown at -70 degrees Fahrenheit!

Here's Don Brown of Quadraplex fame with his Dee Bee IV at the '62 Nats in Glenview, IL. The plane is powered by a K&B .45 and has proportional controls—one of the first!

Examination showed that the silkspaned ribs had been shredded, and that caused the loss of lift. Why? The only possible cause was the sudden 140-degree drop in temperature, and this leads to a good question for you thinkers: did the covering explode or implode with the temperature change? Wesley never did figure it out.

Sure, this is a cute story, but think: when was the last time you flew in the winter? Have you ever dared to fly at zero degrees, let alone -70 degrees? Cold *does* add a challenge. One flier's fingers froze to his transmitter. I recall losing a well-flown LW Senior when the escapement rubber froze! How about you?

LOOKING FOR A TRANSMITTER?

I've often asked for information about Kraft Systems without success. Now, at last, Robert Tede has written to say that he wants to sell a Kraft single-channel tone transmitter with a "C and S Pulsi Tran" coder that was obviously set up for pulse propo. He tells us that it was produced by Ace R/C, and this places it in the very early Kraft era, before Kraft Systems was organized. Phil Kraft's beginnings were "garage style," and he published some of his ideas in magazines. I would guess that the transmitter evolved from one of the publications. Interested? Contact Bob at 195A Lake Tapawingo, Blue Springs, MO 64015.

Here's an early Kraft pulse-tone transmitter produced by Ace R/C. This one is for sale! (See text.)

LIVE WIRE "REBEL"

When we contemplate an OT R/C project, we often go back to our first R/C plane or an early favorite. For example, Russ Whitford of Milwaukee, WI, found an LW Rebel kit in a swap shop. He'll build it as it was intended to be built, but

he'll probably power it with an electric motor. The find was fortunate because Russ's *first* R/C plane was a Rebel.

The story of that first R/C plane is unusually cute. When Russ was 13, he and his 14-year-old brother were given a Rebel that hadn't been flown. With their father's help, they installed a K&B .09 and a World Engines single-channel pulse system.

How they flew it is a new twist. Scared as the devil at first, they let the Rebel fly itself, à la free flight. When it began to drift too far downwind, they simply used the radio to "de-thermalize" it by spiraling it into the ground! According to Russ, there was rarely any damage! As he and his brother gained confidence, they slowly acquired guidance skills.

Later, Russ built a 3-channel Heathkit. Remember that Heath was pretty big in R/C for a while. With three channels in the trusty Rebel, the brothers became proficient in R/C flying.

During all this, their father had remained just the "mechanic." But while the boys were away at college, he also learned to fly with the Rebel—before he destroyed it. After all these years, Russ will have a replica of that first Rebel—good deal!

Russ's bottom line is, which came first: the chicken or the egg? Or, R/C-wise: the LW Trainer or the Rebel? For the record, the LW Trainer was the first true commercial R/C kit. With R/C in the embryonic stage, much was being learned quickly. After a couple of years, it was obvious that it was possible to improve the Trainer, and the Rebel became the fourth kit in the Live Wire

WORLD R/C RECORDS—CRAWLING BEFORE WALKING

In the late '50s, the FAI established categories for R/C records. The Russians were quick to get their names on the record lists. Without a list, any sort of flight—with even *their* rudimentary radios—established a record. For some reason, U.S. fliers didn't jump on the bandwagon.

A phone call from the AMA started this tale. John Worth, who was an AMA executive for many years, was always looking for ways to improve the AMA image. One of his objectives was the World records, and he was looking for people to go after them. He wondered whether I would make an attempt at the closed-course distance record that the Russians had set at 8 or 9 kilometers and the British had recently raised to 13½ kilometers.

At the time, I was deeply involved in preparing for the first World Champs in Zurich, so my time was limited. I could make the attempt only if little preparation was involved, and this meant using a model that I already had.

Fuel consumption was obviously the controlling factor; in those days, fuel tanks were built in. Something I had seen at the previous Nats gave me an idea. Howard Bonner had a .35-powered Astro Hog that he used for pattern. He wanted to fly "pylon," so he replaced the .35 with the required .19 and raced. I thought that if a .19 was enough power for an Astro Hog, it would probably fly my Pursuit, too. If so, the .19 with the available 6 ounces of fuel might just do it.

To make a long story short, the .19 powered the Pursuit adequately, and we established a record of 23 kilometers during a 32-minute flight. Obviously, the distance flown was actually much longer because we flew a wide course around two pylons that were 500 meters apart. I used a Bramco reed radio and a K&B .19 engine, and my Pursuit's flying weight was 5½ pounds. The current record, I believe, is several hundred kilometers, so this was just one small step!

Here I am (in 1960) with my record-setting Pursuit, which was powered by a K&B .19 engine and Bramco reeds. Note the dihedral, which was thought to be necessary in those days.

FÉDÉRATION AÉRONAUTIQUE INTERNATIONALE

Diplôme de Record

HAROLD F. DEBOLT

This is your reward for establishing a world record. This one is for the third closed-course distance record—in French, yet!

It's interesting to note that the preparation for recording the record flight was much more complicated than the flight itself. Fortunately, the AMA took care of the extensive paperwork, but our preparation involved more than the flight.

First, the FAI required the exact location—longitude and latitude—of the flying site. Do you know the longitude and latitude of your flying field? It was perplexing until someone recalled that our field was once an airport. An FAA navigation map pinpointed it for us.

Then we had to have a surveyor lay out the course at exactly 500 meters. Also, the landing had to be within the course. Obviously, we couldn't just go out to the field and put up a record flight—not even in the '50s!

The Flying Bisons of Buffalo were the official sponsor of the attempt. Members Warren Guerr, John Barett and Vernon Krehbiel were the flight officials. Harold Keller was the Flying Bison president and AMA representative.

As with all apsects of our hobby, in setting the records, we had to crawl before we walked, and now we're running full speed ahead!

series. What better tribute could be given to a model design than a quote from Bill Winter (*Model Airplane News* editor during the '50s), who has often said, "In my mind, the Rebel is the most outstanding design of the early R/C era." The original Rebel is in the AMA museum.

Speaking of the Rebel, Burl Anderson of Galesburg, IL, honors us with a photo of his latest—one of many, he says. This one is powered by a 540 electric motor and an Olympus belt drive using six 1400mAh SCR cells. Using an Ace R/C system, Burl enjoys 7-minute flights, which compare favorably with previous engine-powered flights.

Burl says he enjoys the "Golden Age of Radio Control" enormously and notes that he still flies his '59 vintage Champ and a Jenny and a P-Shooter of later days.

You may recall that Stoney Stonemann of Garland, TX, told us about his Ken-Hi "Buzzer'd," and when I asked for photos, he told me this tale, which could have come from the CB days of the '50s. Stoney decided that he could get some quick air time at a neighborhood park. A teenage bystander was on hand with his portable CB radio. Stoney asked him not to use the CB while he was flying. But in flight, the Buzzer'd suddenly went straight in. With that, the CB'er said, "Sorry to break your old man's toy." A heated discussion followed, and in frustration, Stoney started to walk away, but he was grabbed from behind. Two stomps settled that; one put the culprit's foot in a cast, and the other put the CB in the trash! Moral: be careful of old R/C'ers and their cherished toys!

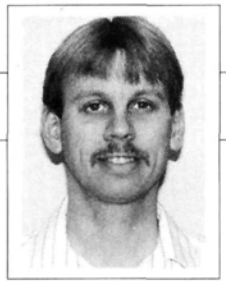
Stoney concludes by telling us the Buzzer'd will be his Phoenix: with some of the original pieces, it will rise from the ashes.

THAT'S NOT BILL!

Jerry Chastain of Richman, CA, wrote to correct the caption on a photo in the August '93 issue. The model in the picture was a magnificent Fleet biplane, and the modeler is said to be Bill Dean.

(Continued on page 150)

CENTER ON LIFT



MICHAEL LACHOWSKI

FUTABA'S NEW 7UGFS RADIO

PROGRAMMING COMPUTER radios can be intimidating, especially the first time. This month, I cover the new Futaba* FP-7UGFS—a relatively easy-to-program radio—even for newcomers. It's definitely worth a look if you want some of the mixing features of a computer radio but you don't want a 100-page manual, fancy options, flight modes, or custom mixing.

FUTABA FP-7UGFS TEST DRIVE

This 7-channel FM programmable glider radio includes a compact FP-R148DF receiver, two S-133 servos, a square receiver pack and a charger. It's perfect for pilots who want to fly sailplanes with multiple servos in the wing but who don't want the complexity of a top-of-the-line computer radio. The 7UGFS meets all the basic needs of modern sailplanes, including pre-sets, crow and individual servos for each control surface. The typical-sailplane setup procedure that's included in the manual is all you need to get started in programming.

Programming is accomplished using six push-buttons on the face of the transmitter. Information about the function being programmed appears on the LCD display.

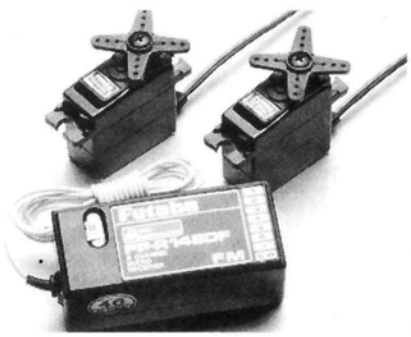
My first test for programming the radio was in a 2-meter model with two aileron servos and one flap servo. This setup took 1½ hours, including a false start when programming the GLID-1F mode. (If you have more than two servos in the wing, use GLID-2F.) It took me 2 hours to install the radio in a 2-meter model with six servos (including servo installation).

THE TRANSMITTER

The 7UGF transmitter configuration is for a sailplane. In addition to the two sticks, there are six switches and two pots. These are used for dual rates, programmable mixes, two flight modes and adjusting flaps. You use six keys (on the front of the transmitter) and an LCD display to do all the programming.

During normal operations, the LCD display provides the battery voltage, an RF on/off indicator, a timer (minutes only) and the model number selected. It displays the function being programmed, the affected channels, the activation setting and the percentage setting. Programming is easy after you've learned the use of each channel.

The flight-mode switch (the SPEED and START settings) is positioned above the flap stick. The elevator dual rate/exponential switch is next to this switch; it turns the butterfly (crow) mixing on and off. The transmitter beeps if the mixing is on when you turn on the transmitter (toggling the crow-mixing switch silences the beeper). I'd prefer to be able to set mixing on permanently (in other words, avoid this beeper entirely), which you can usually do with more expensive radios. *[Editor's note: Futaba regards the beeper as an important safety measure and notes that this feature is also incoporated in the 9Z series. The 9Z permits the user to turn the beeper off but does not permit disabling a flashing LCD.]* You do have the option of selecting normal- or reverse-flap stick operation (which some pilots prefer).



The molded-plastic transmitter is comfortable to hold; the contour of the back of the case makes this easy whether you hold the transmitter with one or two hands. When I fly using two fingers on the sticks, I think the balance of the transmitter is a little high, which makes the transmitter difficult to hold toward the end of very long flights. The balance is better for pilots who fly using their thumbs on the sticks.

The trim levers have solid detents for the center position and are easy to find when you're flying. The sticks' lengths are adjustable, and after you've removed the back of the case, you can change the stick tension by adjusting the screws. A

SPECIFICATIONS

Radio: Futaba FP-7UGFS FM system for gliders
List price: $879.95
Channels: 7
Modulation: FM/PCM
Model memories: 4
Receiver: FP-R148DF dual-conversion (8-channel)
Servos: two FP-S133 microservos

Comments: this radio has programs for GLID-1F (two wing servos), GLID-2F (three to four wing servos) and ACRO (aircraft). The system includes functions such as ATV, dual rates, exponential, reversing, sub-trims, launch and speed pre-sets, butterfly (crow) mixing, V-tail mixing, aileron-rudder mixing and flaperon or aileron differential, and it has two programmable mixers.

AERO-TOWING SAILPLANES

I'd like to tell you about an interesting videotape on aero-towing—an alternative method for launching sailplanes. It's just like full-size-sailplane aero-towing: a powered plane tows the sailplane to launch altitude and then releases it for soaring flight. John Clarke* has put together an excellent video that also features some beautiful scale sailplanes. All of the towing flight shots are of scale sailplanes—including some very large ¼- and ⅓-scale models.

The 35-minute video first examines all the equipment that's needed for aero-towing: a towline that can absorb shock, and line releases on both the sailplane and the tow-plane. The tape shows how the releases work and where to position them, and it has examples of commercial releases and releases you can make yourself.

A key point is that sailplanes need to be matched to tow-planes of the same performance, because both must fly at the same speed during the tow. The video features airplanes of various sizes so you can estimate which kind of tow-plane you'll need. The narration of the tows details the piloting techniques that are required for both the tow pilot and the glider pilot. If you're curious about aero-towing and you share a field with power fliers, get this video for $19.95 from John Clarke, and do some aero-towing.

500mAh battery powers the transmitter for 10 flights of 10 minutes each.

PROGRAM FEATURES

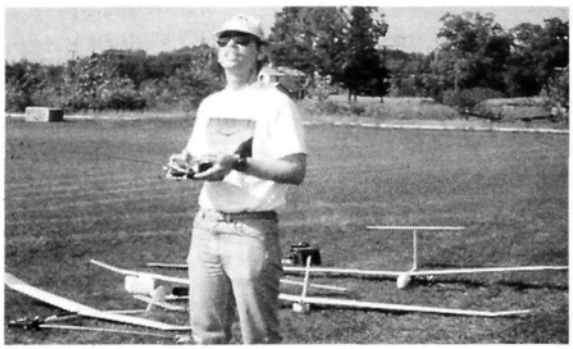
Even though only four characters on the LCD display the selected function, it's easy to figure out what they mean. When you use the GLID-2F setup, there are 20 functions to select from. The two other setups are GLID-1F and ACRO. Use the GLID-1F function when you have only two servos in the wing, such as in a flap-eron model. If you have more servos, use the GLID-2F program. The ACRO setup has some of the mixes you'll want for a flying-wing slope ship. The transmitter has only four model memories, and a number identifies each one (there aren't any model names).

All of the setups allow servo-reversing, setting servo endpoints with adjustable travel volume, and dual rates and expo-nential on the basic controls. For servo centering, the sub-trim function provides a very fine level of adjustment on the servo-trim adjustments after you've set the linkages close to the final positions. There are two programmable mixes that can mix one channel into another. There aren't any options for having a mix entered before or after other mixes for a given channel as you would get in a more powerful transmitter, but I doubt if you'll ever need these mixers for a conventional sailplane.

PROGRAMMING A TWO-AILERON, TWO-FLAP MODEL

A standard six-servo sailplane is easy to set up using the GLID-2F option. All the necessary mixes for crow, launch pre-set and trailing-edge reflex are built in. Aileron differential, mixing ailerons into flaps and rudder mixing—all of which can help during a turn—are part of the program.

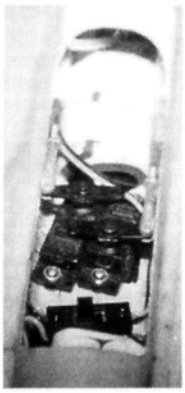
Futaba provides a 43-page manual about the radio and programming. Three pages of the manual cover all the steps necessary to set up models using GLID-2F. After you know how the edit keys work, you can follow these steps and set up your model.



The author enjoys a beautiful day soaring with the Futaba FP-7UGFS controlling his Aeolus 2-meter design. The T-shirt is an original design by Cody Robertson* of Flagstaff, AZ. It features a V-tail sailplane and a pilot on the side of a hill.

FLIGHT PACK

You'll need at least a 7-channel receiver because the left-aileron output is on channel 7. Futaba packages the dual-conversion, 8-channel receiver with the radio. The receiver is less than 1 inch square on the end and less than 2 inches long, so it's easy to fit into almost any sailplane. Two S133 servos, which are useful to sailplane pilots, are in the flight pack. The remaining flight-pack components are a switch and a square 500mAh flight pack that is the most common shape for mounting in a sail-plane. If you use six servos, consider getting a pack with a higher capacity if you frequently fly for more than an hour.



The flight pack easily fits almost any sailplane. Note the angle on the servos to permit use of longer servo arms.

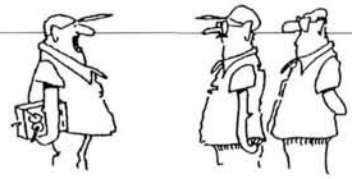
SUMMARY

The FP-7UGFS is a nicely configured computerized glider radio. It provides all the functions necessary for a modern thermal sailplane. Because it doesn't include all of the options included in some other radios, setup and programming are simple. The limit of four model setups might be a problem only if you were hoping to computerize your entire fleet with one transmitter.

This radio is a little pricey, especially compared with Futaba's equivalent radios for power and helicopter. If the prices were comparable to those of other manufacturers' low-range, i.e., less expensive, programmable radios, the

(Continued on page 150)

CLUB OF THE MONTH



MID-STATE AEROGUIDANCE CLUB

307 W. Fifth St., Marshfield, WI 54449

IN THE SEPTEMBER *Just Plane Talk* newsletter, Mid-State Aeroguidance Club president Don Zais thanked the instructors who devote their time to teaching new students the great sport of R/C modeling: "Isn't it a thrill to leave your hand off the trainer switch and allow the students to take off and land on their own? The smile on their faces says it all." Don, we couldn't agree with you more. We applaud your club for helping to promote the sport among youngsters, and we hope that you'll continue to do so.

The newsletter is full of helpful tips, such as one offered by member Joe Mayer. Joe suggested that pilots should place their transmitters on a shelf or a table while they wait for the next available frequency. This would prevent pilots from accidentally turning on their transmitters in the pit area. Other members suggested a method for controlling frequency: each pilot would write his name on a clothespin and place it on the frequency board number that corresponds to his radio's channel number. This would let other pilots know which frequencies are being used and when they'll be free.

A section called "What's Happening" lists interesting events for the next two months. In "Engine Quitting Problems Explained," Duke Fox reports that engines often get a bad rap for quitting, when, in fact, the fuel tank is to blame.

The club's video library welcomes the "Wring It Out" Volume 3 video by Carl Goldberg Models Inc. The short review states, "This is an interesting tape for the pilot who wants to do more than simply fly around and 'burn holes' in the sky."

For their dedication to teaching the sport to kids and for offering helpful tips, we award the Mid-State Aeroguidance Club two subscriptions to *Model Airplane News*. Congratulations! ■

SPORTY SCALE

(Continued from page 123)

Webra; *distributed by Horizon Hobby Distributors, P.O. Box 3726, Champaign, IL 61826.*
Red Max Fuel; *distributed by FHS Supply, Box 9, 239 Bethel Church Rd., Clover, SC 29710.*
Sig Mfg. Co., *401 S. Front St., Montezuma, IA 50171.*
Frank Tiano Enterprises, *15300 Estancia Ln., W. Palm Beach, FL 33414; (407) 795-6608.* ■

GOLDEN AGE

(Continued from page 126)

But almost anyone from that era will recognize him as the prolific Calhoun Smith. The mistake probably occurred because a note on the back of the old photo credited it to Bill Dean. We know that right up to his early departure, Cal was a world-class modeler and artist who blessed us with his most imaginative magazine artwork and covers. Bill Dean was another fine modeler of the era and an excellent photographer, as the photo shows. Both added much to our hobby!

And so it was. Remember, this is your OT R/C place! ■

CENTER ON LIFT

(Continued from page 134)

Futaba would be high on my list. Because it is a bit more expensive, you really have to compare it with the mid-range computer radios, which have more mixing options and more model memories.

[Editor's note: Futaba responds that the FP-7UGFS includes a dual-conversion, 8-channel micro-receiver and two S-133 servos, which tend to drive the cost of the radio system up. Futaba also argues that the primary value of this radio can be found in its basic programming features (see specifications box), and that the number of mixing options and model memories is a secondary issue.]

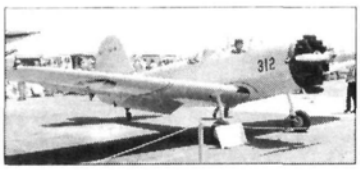
** Here are the addresses that are pertinent to this article:*
Futaba Corp. of America, *4 Studebaker, Irvine, CA 92718.*
John F. Clarke, *911 Covert Ave., New Hyde Park, NY 11040.*
Cody Robertson, *3231 S. Little Dr. Flagstaff, AZ 86001.* ■

NAME THAT PLANE

CAN YOU IDENTIFY THIS AIRCRAFT?

If so, send your answer to *Model Airplane News*, **Name That Plane Contest** (state issue in which plane appeared), 251 Danbury Rd., Wilton, CT 06897.

CONGRATULATIONS to Carl Diehl of Ormond Beach, FL, for correctly identifying the October '93 mystery plane. The Timm N2T-1 Tutor was built in the early '40s by the Timm Aircraft Company in Van Nuys, CA, which used molded plywood and plastic binder (the "Aeromold process") to build the airframe. The company delivered 262 aircraft to the U.S. Navy in 1943.



The Tutor was powered by a Continental W-670-6, 220hp radial engine. The 2,725-pound plane had a wingspan of 36 feet and a length of 24 feet, 10 inches. It had a maximum air speed of 144mph, a service ceiling of 16,000 feet and a range of approximately 400 miles. After WW II, many Tutors were sold to the civilian aviation market for as little as $600. (Photo courtesy of Bob Banka, Scale Model Research.)

The winner will be drawn four weeks following publication from correct answers received (on a postcard delivered by U.S. Mail), and will receive a free one-year subscription to **Model Airplane News.** *If already a subscriber, the winner will receive a free one-year extension of his subscription.*

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For more information, call toll-free (800) 243-6685 and ask for Arlene Melko.

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To run your ad for more than one month, multiply your payment by the number of months you want it to run. Deadline: the 10th day of the month, 3 months in advance e.g., *January 10 for the April issue.* We don't furnish box numbers, and it isn't our policy to send tear sheets. **SEND AD AND PAYMENT TO: CLASSIFIED ADS, Model Airplane News, 251 Danbury Rd., Wilton, CT 06897.**

FIRST ANNUAL GATOR SHOOTOUT at the R/C World flying site in Orlando, FL. If you want to enjoy world-class scale competition, join us the weekend of January 14 through 16, 1994. Forty of the best scale builders and fliers have been invited to compete. Wally Zober and Dixie Cutrone are contest directors. Need accommodations? The **R/C World condos** are available for a super R/C and Disneyworld vacation, but they *must* be reserved *in advance.* Contact Lonie Charlson, (407) 380-6359. [2/94]

R/C WORLD ORLANDO, FL, CONDO RENTAL: 2 bedroom, furnished. Available weekly or monthly. Low rates. 100-acre flying field with enclosed hangars. Close to Disney World and Epcot Center. For information, please call or write to R/C World, 1302 Stearman Ct., Orlando, FL 32825; (407) 380-6359.

WANTED: model engines and race cars before 1950. Don Blackburn, P.O. Box 15143, Amarillo, TX 79105; (806) 622-1657. [6/94]

WANTED: your old proportional radios; interested in pre-1980, American made; C&S, Deans, Klinetronics Spar and others. Older is better. Ron Gwara, 21 Circle Dr., Waverly, NY 14892; (607) 565-7486. [9/94]

WANTED: model-airplane engines and model race cars made before 1950. Jim Clem, 1201 E. 10, P.O. Box 524, Sand Springs, OK 74063; (918) 245-3649. [6/94]

LOCKHEED P-38 LIGHTNING—Are you a P-38 Lightning fan?—R/C models or full-size? Join the P-38 Model Organization International! For more information, send $1 to the P-38 Model Organization International, Medelbyvej 54, 2610 Rodovre, Copenhagen, Denmark. [2/94]

MISSILE SECRETS—engines, rockets, U-build. $2. Northtech-A5, 813 Cherry Ave., Albany, GA 31710

WANTED: old engine parts, misc. junk before 1970. Wesley Pettinger, 1501 Banbury Ct., Richardson, TX 75082; (214) 669-4003. [7/94]

R/C FLIERS' DREAM COME TRUE. Vacation with your family, and bring your R/C plane! R/C World is a radio-control community with beautifully furnished condo (pool, tennis included), and one of the world's finest flying sites. All this only 20-30 minutes from Disney, Epcot, Universal Studios, Seaworld, and about 1 hour to Kennedy Space Center. For more information, call or write to Dave Patrick, P.O. Box 1385, Oak Park, IL 60304. (708) 771-6697. [1/94]

CLEVELAND KITS (AND PLANS) WANTED: Immediate cash, call or ship for offer. Ship to Jay Herbert, P.O. Box 1286, Mattituck, NY 11952. Phone (516) 298-4135 or fax (516) 298-4181. [3/94]

ANTIQUE IGNITION AND GLOW PARTS CATALOGE:100 pages–timers, needle valves, orginal cylinder heads, point sets, drive washers, stacks, spark plugs, plans. Engines: Atwoods, Baby Cyclones, McCoys, Hornets, others. $8 post-paid, U.S.; $20, foreign. Chris Rossbach, R.D. 1 Queensboro Manor, Box 390, Gloversville, NY 12078. [2/94]

MAGAZINE BACK ISSUES—Flying Aces, Model Airplane News, Air Trails, 1930s and '40s. FM, RCM and more. Send SASE for list to Carolyn Gierke, 1276 Ransom Rd., Lancaster, NY 14086. [2/94]

IMPORTED DIESEL ENGINES—world's best selection: AE, AM, Aurora, Cipolla, KMD, MAP3, Mikro, MK-17, MVVS, Modela, PAW, Pfeffer, Letmo and USE diesels, plus very special imported glow engines, CO_2 motors and sailplane kits. Ten-page catalogue—$1. Carlson Engine Imports, 814 E. Marconi, Phoenix, AZ 85022-3112.

SCALE WW I Plans: Send $1 for current list. "Smileys," 23 Riverbend Rd., Newmarket, NH 0385 [2/94]

NEW ZEALAND AERO PRODUCTS—Scale plans: Agwagon, Pawnee, Pawnee Brave, Airtruk/Skyfarmer, Fletcher FU-24, Aerobat, Hall's Springfield Bulldog, Typhoon, DC-3/C-47, Fairchild PT-19/Fleet PT-26 and more. Fiberglass parts; hardware packs; timber packs; color photo packs available. Free documentation with plans. Catalogue/price list: $5 (U.S.); Visa/MC. 34 Ward Parade, Stirling Point, Bluff, New Zealand; (03)2128192.

FREE—Tesla turbine plans. Contact Dan, 1214 N, 6th St., Port Hueneme, CA 93041. [2/94]

WANTED—Kraft KP-4/6 from 1964-66. Karlheinz Schmid, Stieranger 7, 8900 Augsburg 21, Germany. [2/94]

PARACHUTIST! Release a scale-like parachutist! A real crowd pleaser and a lot of fun! For a brochure and jump contest rules, SASE: Hobby Hut Mfg., 2040 W. 21st St. N., Suite #77, Dept. MAN, Wichita, KS 67203 [3/94]

GIANT-SCALE PLANS—Blohm and Voss BV-138 3-engine flying boat plus other maritime aircraft. Two stamps for listings. Gene Falada, Sea-Clusion Aeronautics, 22W070 Byron St., Addison, IL 60101. [11/93]

INSTRUCTORS SCARCE? Our VHS R/C flight instruction tapes will get you started! Free catalogue! Silicon Valley R/C Technologies: (800) 822-1500. [12/93]

QUIET YOUR ENGINE with Koosh-In-It—a flexible, rubber-fabric laminate that "softens" engine vibration. Install it between the engine, engine mount and/or firewall. Pad measures 2 1/2x4 inches and is 1/16 inch thick, and it can be cut easily with blade or scissors. Only $5.80, postage-paid. Balsadust, P.O. Box 078, New York, NY 10021-0078; (212) 737-0071. [3/94]

WRENCHES AND GASKETS for vintage and newer engines Bob McCord 325 Sylvan Mountain View, CA 94041. [3/94]

SCALE DOCUMENTATION-MODEL PLANS—Drawings, photo packs, monographs, unusual aircraft. Illustrated catalogue: $2 (post-paid). Bill Young, 8106 Teesdale, N. Hollywood, CA 91605. [4/94]

"VACUUM FORMING." This 128-page illustrated book shows how to make light plastic parts. Get professional results with low-cost equipment. Over 7,000 copies sold. Try it for yourself—$9.95 (plus $1.05 S&H). Coming this fall: complete machines, components and supplies. Vacuum Form, 272 Morganhill Dr., Lake Orion, MI 48360; (800) 391-2974. [1/94]

GRAND OPENING—Magic Tunes Catalogue. CDs, tapes and accessories for your listening pleasure. Grand opening prizes, giveaways, gifts, special offers. Send $2 to Box 65031, Los Angeles, CA 90065. [12/93]

HELICOPTER SCHOOL—five days of hands-on instruction with X-Cell helicopters and Futuba computer radios. Small classes tailored to your individual needs. Beginner to expert. Includes all meals and lodging. Over 300 satisfied students and 10,000 flights logged. Located on a 67-acre airport used exclusively for R/C training; owned and operated by Ernie Huber, five-time National Helicopter Champion and helicopter designer. Send for *free* information and class schedule *now!* R/C Flight Training Center, P.O. Box 727, Crescent City, FL 32112-0727, or call (800) 452-1677. Outside USA: (904) 698-4275, or fax (904) 698-4724. [3/94]

FOUR 1993 SCALE CATALOGUES. SPPS super-scale plans; SPPS scale documentation; ASP scale plans handbook; ASP aircraft scale drawings handbook (three-views). Catalogue—$5 (overseas airmail, add $5 for one to four catalogues); 140 different scale plans; 120,000 photos; Visa/MC. Jim Pepino's Scale Plans and Photo Service, 3209 Madison Ave., Greensboro, NC 27403; (919) 292-5239. [4/94]

IMPORTED DIESEL ENGINES—world's best selection: AE, AM, Aurora, Cipolla, KMD, MAP3, Mikro, MK-17, MVVS, Modela, PAW, Pfeffer, Letmo and USE diesels, plus very special imported glow engines, CO_2 motors and sailplane kits. Ten-page catalogue—$1. Carlson Engine Imports, 814 E. Marconi, Phoenix, AZ 85022-3112.

ANTIQUE AIRPLANE PRINTS, 8x10 color prints. Stearman, Gee Bee, Waco, Jenny, P.T. Ryan; 10 in all. Send $1 (refundable) for color brochure. Robert Kohr, P.O. Box 204, York, PA 17405. [5/94]

SALE—kits: wood, plastic; ignition engines; parts and mags (pre-1965). Specify needs. Send SASE and 60 cents for list. Leonard Roberts, 3819 Lydon Ln., Moosic, PA 18507; (717) 961-2357. [12/94]

OLD MODEL MAGAZINES. Send SASE for list to Dave Bessel, P.O. Box 669, Poway, CA 92074 [2/94]

PAYING $50 each for toy metal outboard boat motors. Oliver, Evinrude, Johnson, Gale, Wen-Mac, Sea-Fury, etc. Richard Gronowski, 140 N. Garfield Ave., Traverse City, MI 49684; (616) 941-2111. [5/94]

THE TOOL RESOURCE has the right tool for the right job—the finest quality hand tools, soldering equipment, tool bags, etc., specifically for hobbyists, technicians, service professionals. Current catalogues available. Write: The Tool Resource, Dept. MA, P.O. Box 1106, W. Dundee, IL 60118; fax (708) 468-0849. [2/94]

WANTED: full-size Monogram catalogues. Quantity, year, condition, price (each), shipping charges and daytime phone number (first correspondence). John Bickett, P.O. Box 38383, Colorado Springs, CO, 80937-8383. [2/94]

CUSTOM KIT BUILDING. Will build most kits from trainers to quarter scale; 20 years experience. Write for quotes: Midwest Model Factory, 280060 Highland Rd., Minatare, NE 69356. [2/94]

WANTED: built or partially built Ercoupes, Cessna 150, 152, 172, 182, Grumman American Tiger (AA5), American Yankee (AA1), or Mooney M-10 Cadet. Glen Mills, P.O. Box 3393, Mission Viejo, CA 92690; (714) 768-0585. [11/94]

PLANS ENLARGED. Scanning/plotting services; model designer's computer software; free information. Concept, P.O. Box 669E, Poway, CA 92074-0669; (619) 486-2464.

MAKE REAL DECALS with your computer and printer! Send $10 for starter kit and instructions to LABCO, 27563 Dover, Warren, MI 48093-4764. [5/94]

GIANT-SCALE PLANS by Hostetler. Send SASE to Wendell Hostetler's Plans, 1041 B Heatherwood, Orrville, OH 44667. [11/94]

PC-PERFORMANCE—easy-to-use, menu-driven computer program predicts flight performance of R/C model aircraft. For IBM PC compatibles with monochrome or color graphics capability. Introductory price—$15 plus $3 S&H. Specify disk format. Softair, 10710 Evergreen Way #D305, Everett, WA 98204. [1/94]

CUSTOM-BUILT MODELS: 17 years experience. Will build your R/C project. Quality craftsmanship, reasonable rates, satisfaction guaranteed. Specializing in ducted fan and giant scale. Giant Scale Models, 1603 N. Main St., Ste. E, Anderson, SC 29621; (803) 224-0797; fax (803) 225-4465. [2/94]

FREE ASP AIRCRAFT PLANS LIST. Master list of plans published in British magazines. Send large SASE for list; send $6 for "Best in Scale" catalogue. Bob Holman Best in Scale, P.O. Box 741, San Bernardino, CA 92402; (909) 885-3959. [1/94]

WANTED—control-line profile kits: Midwest P-63, Skyraider, P-51, ME-109, Sterling Navion, Starfire, Skyshark, P-40, Sportster. Throttles: Rotovalve, Dynamic 19/60, McCoy 19/35 RD/BL, K&B 19/35 grn. Engines: McCoy 19/35 R/C RD/BL, three-line bellcranks. Paul Patterer, 114 Mosher Ave., Battle Creek, MI 49017; (616) 965-5364. [12/93]

ENGINES: IGNITION, GLOW, DIESEL—new, used, collectors, runners. Sell, trade, buy. Send $3 for huge list to Rob Eierman, 504 Las Posas, Ridgecrest, CA 93555; (619) 375-5537. [5/94]

FOR SALE: O.S. .61 Hanno, N.I.B.—$295. Futaba 5UAP, like new—$185. Call Mike, (814) 835-2044. [1/94]

ARE YOU TIRED OF PAYING $1.29 for six screws? For a *free* catalogue and price list of screws, nuts, locknuts, blind nuts and more, in sizes from 0-80 to 1/4 inch, contact Micro Fasteners, 110 Hillcrest Rd., Flemington, NJ 08822; (800) 892-6917; fax (908) 788-2607. [5/94]

FUTURISTIC DUCTED-FAN CONSTRUCTION VIDEO: A revolutionary way to build a ducted-fan, delta canard R/C aircraft with vectored thrust. The video takes you step by step from computer design construction to the actual flight. The aircraft is designed for easy building, high- and low-speed maneuverability and vertical flight capability. It's lightweight and *affordable.* On sale, late summer. For *free* details, prototype spec sheet and updates, write to MVP, 2 Hinrichs Pl., Ste. 2, Bloomfield, NJ 07003; (201) 680-0331. [1/94]

R/C COMPOSITES—Example: carbon fiber, 100' 0.25" by 0.007" tow—$5.75, postage-paid; send SASE for example applications sheet, free samples and price list to R/C Composites, P.O. Box 832, Newark DE 19715. [2/94]

SCALE AIRCRAFT DOCUMENTATION and RESOURCE GUIDE. World's largest commercial collection. Over 5,000 different color Foto-Paaks and more than 22,000 three-views; 152-page resource guide/catalogue—$6; Canada—$7; foreign—$12. Scale Model Research, 3114 Yukon Ave., Costa Mesa, CA 92626; (714) 979-8058. [2/94]

MODEL MOTORS WANTED—Most types, 1970 and earlier. Cash or trade. T. Crouss, 100 Smyrna, West Springfield, MA 01089. [3/94]

FOR SALE: Custom-built Python 120 pattern plane with retracts and plug-in wings and stab. Brand-new—$1,200. Also Yellow F-4 Phantom with new O.S. 91 and Dynamax, six Futaba B.B. servos and Spring Air retracts; custom paint finish—$1,500. Jack Bielecki (403) 239-6181. [2/94]

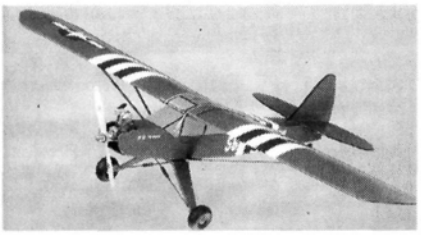
FOR SALE: Ignition engines, all pre-1950. Send large SASE: Leonard Roberts, 3819 Lydon Lane, Moosic, PA 18507; (717) 961-2357. [3/94]

FOR SALE: 5.8 Sachs engine (single-cylinder, 2-cycle, 10hp). Brand-new—$495. 2315 Mahoning Rd., N.E.#1, Canyon, OH 44705-1913. [2/94]

WANTED: Cap 21, 10B, 231 or other (any brand); wings for Piolet Diablo; Don Harris mufflers; Spring Airs; used Shuttle 2X; Concept. Jeff, 5571 Lakeside Dr. #106, Margate, FL 33063; (305) 968-2087. [1/94]

STOP ENDLESS SEARCHING—R/C magazines as references you need to finish projects. Model-Base—a comprehensive database of R/C articles from major magazines—puts the information at your fingertips. A user-friendly, expandable database, Model-Base runs on IBM-PCs and compatibles (80286 or above). EGA/VGA graphics recommended. For your Model-Base demo, send $5 to TFH Software, Dept. MAN, P.O. Box 765, Collegedale, TN 37315. Specify 3.5 or 5.25. First 50 demo requests get $10 off the complete software package. For information only, send long SASE. [2/94]

PRODUCT NEWS

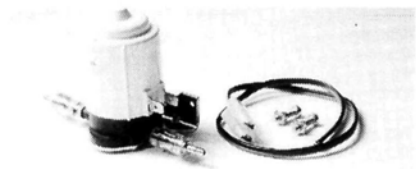


U.S. AIRCORE
Army AirCore 40

The Army AirCore 40 is a high-wing look-alike of the famous L-4 Army observation plane of WW II. It sports a 64-inch "multi-mission multi-airfoil" wing that has both a semisymmetrical mid-wing for advanced aerobatics and special AirCore-designed, NASA-inspired wingtips for gentle, predictable landing and stalling. With a light wing loading of only 19 ounces per square foot and excellent slow-flight characteristics, the durable AA40 is a good trainer. The kit comes ready to assemble; you provide a 4-channel radio, either a .40 to .50 2-stroke engine or a .48 to .53 4-stroke engine, wheels and throttle linkage. Specifications: wingspan—64 inches; wing area—698 square inches; wing loading—19 ounces per square inch; ready-to-fly weight—5.75 pounds.

Kit no.—USA2090; **price**—$129.95.

U.S. AirCore Inc., 4576 Claire Chennault, Hangar #7, Dallas, TX 75248; (214) 250-1914; fax (214) 250-6532.



HOBBY LOBBY
Sealed Electric Fuel Pump

Made in Germany by Kavan, this sealed electric fuel pump fuels and defuels. It has lapped brass gears for durability, and it can be used for gasoline, diesel and glow fuels. Specifications: 2¾ inches tall; requires 12 volts.

Part no.—HLFK190; **price**—$25.30.

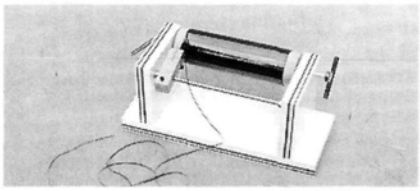
Hobby Lobby Intl., 5614 Franklin Pike Cir., Brentwood, TN 37027; (615) 373-1444.

BOB VIOLETT MODELS
Jet Wheels and B.V. Brake

These wheels and the B.V. Brake solve the ground handling problems associated with jets. The one-piece wheels are CNC-machined of aluminum and use precision-matched brass bushings and stainless-steel axles. The many machine screws around the rims extend all the way through the tires to ensure that they won't spin off. The tires are molded out of a tough rubber compound that provides the proper balance of sidewall strength and good traction.

The B.V. Brake (patent pending) is a simple and trouble-free pneumatic design that applies pressure to the wheel's drum rather than pushing the wheel outboard against a small axle boss. Five sizes (from 2¼ to 3½ inches diameter) with scale-looking disk covers are available.

Bob Violett Models Inc., 170 State Rd. 419, Winter Springs, FL 32708; (407) 327-6333; fax (407) 327-5020.

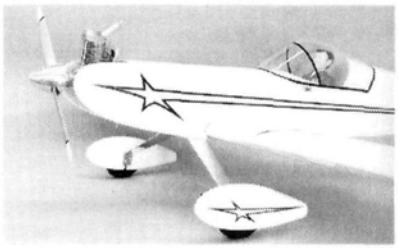


CUSTOM CUT TOOL
Stripping Tool

This tool will accurately strip all types of plastic film (including iron-on) materials in widths from 1/32 inch to 4⅝ inches and in lengths of up to 6 feet. Its blade can be quickly replaced; no straightedge is required; and no material is wasted. Pinstripes can be easily cut in seconds. Minimal assembly is required.

Price—$14.95 (plus $3.50 S&H).

Custom Cut, RD 3, Box 167A, Chester, VT 05143; (800) 874-3574, or (802) 869-2508.



SIG MANUFACTURING
Four-Star 120 Wheel Pants

Although these wheel pants were developed as an optional accessory for the Sig Four-Star 120 kit, they can be used on any big model with 4- to 4½-inch main wheels. They're molded in halves of ABS plastic. Specifications: length—10¾ inches; width—2 inches; height—2 9/16 inches. These aren't paper-thin pants that will break during your first flight. They're tough enough for everyday use.

Part no.—SH-744; **price**—$9.95/ pair.

Sig Mfg. Co. Inc., 401-7 S. Front St., Montezuma, IA 50171; (515) 623-5154.

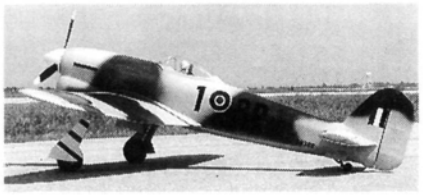
DAVIS DIESEL DEVELOPMENT
Diesel Power

DDD has developed Diesel Power concentrates to eliminate the kerosene odor and guarantee fuel freshness. Each concentrate contains all the primary fuel ingredients—except the kerosene. Just take the concentrate, add deodorized kerosene or hurricane-lamp oil, and you've instantly created a fresh, odorless or lilac-scented fuel! Diesel Power fuel is available in four blends; in various fragrances; as a concentrate and premixed; and packaged in quarts and gallons.

For a complete catalogue, send a 75-cent SASE and $3 (to be credited toward your first order).

Davis Diesel Development Inc., P.O. Box 141, Milford, CT 06460; (203) 877-1670.

PRODUCT NEWS



DAVES CUSTOM MODELS
Hawker Typhoon 1B

This warbird kit includes an epoxy/glass fuselage, foam-cores, a fiberglass cowl, a canopy, an aluminum spinner, templates and full three-view plans. At its thickest point, the wing root is 4¾ inches, so the plane flies well and is easy to land. Specifications: wingspan—92 inches; fuselage—79 inches; wing chord—21 inches; wing area—approximately 1,650 inches. It requires a 6-channel radio. The Typhoon is available as a short kit and as a full kit. The full kit includes all the wood and hand-shaped parts needed to finish it.

Prices—$450 (full kit), $275 (short kit)—plus $25 S&H.

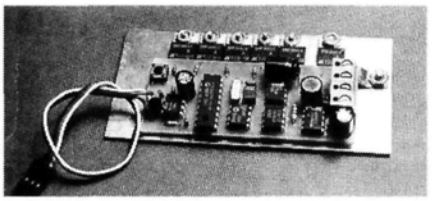
Daves Custom Models, 27B Spring Cir. Dr., Austin, TX 78736; (512) 288-2055.

J'TEC
Zenoah G-23 Snuf-Vibe Engine Mount

This mount is designed to "snuff out" engine vibration, reduce noise and protect sensitive R/C equipment. It's easy to attach—just bolt it onto the back of the engine and the firewall. Each mounting kit contains two cast-aluminum mounting plates, four 10-32 socket-head bolts, 12 steel washers, four T-nuts and 20 special-formula-rubber step bushings.

Part no.—JT-Z23SV; **price**—$32.95 (plus $3 S&H).

J'tec, 164 School St., Daly City, CA 94014; (415) 756-3400.

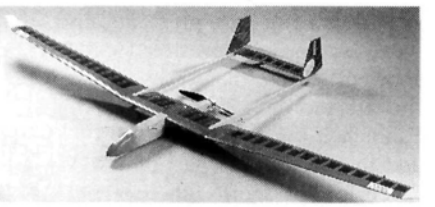


JOMAR
Maxcell Throttle

The Maxcell Throttle for electric motors is microprocessor controlled and can handle from 12 to 40 cells at a continuous current to 40 amps. It features a 5kHz "chop rate" for efficiency, 100V Mosfet transistors, "one-button" computer setup, signal filtering, optical isolation, safety shutdown and "soft-start." A brake for competitive applications is also included. The 1.8-ounce unit comes mounted on an aluminum heat-sink plate and has a Futaba J lead.

Price—$149.

Jomar, 3440 Riverhills Dr., Cincinnati, OH 45244; (513) 271-3903.



JAMARA
Sunriser

This uncomplicated, high-performance model from Germany is constructed mainly of balsa and offers very good flight performance. It can be powered by 7- to 24-cell battery packs. The central fuselage doesn't contain any servos or rods (they're installed in the wing). Owing to the model's variable tail plane, different types of motors—from a simple direct-drive motor to a geared motor—can be installed without an extension shaft. Specifications: wingspan—100 in. (2,500mm); length—50.76 in. (1,269mm); wing area—39.2 qdm., weight—1,200 to 2,100g.

Kit no.—02 0020.

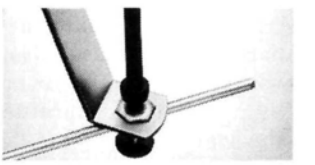
Jamara, Inh. Erich Natterer, Gewerbegebiet 5, D-88317 Aichstetten, Germany; phone 07565-1692; fax 07565-1854.

PRECISION AERO
Sukhoi 26M

The SU-26M has been faithfully reproduced by Precision Aero in both scale appearance and performance. The deluxe kit includes balsa (many of the parts are already cut), plastic parts, foam-cores, plywood parts and hardware. The budget kit has everything except the balsa. Specifications: wingspan—54 inches; engine—.35 to .45; weight—4.5 to 5 pounds; radio—4-channel.

Prices—$69.95 (budget; plus $6.50 S&H), $99.95 (deluxe; plus $7.50 S&H).

Precision Aero, 1561 River Highlands Dr., Oconomowoc, WI 53066; (414) 567-5341.



DU-BRO PRODUCTS
Kwik Grip E/Z Connector & Wrench

This connector features a hex-style design that allows you to hold it securely while you tighten the screw. The wrench allows you to secure the connector from six angles, giving you a tight grip while tightening the locking screw. It also eliminates bending the pushrods.

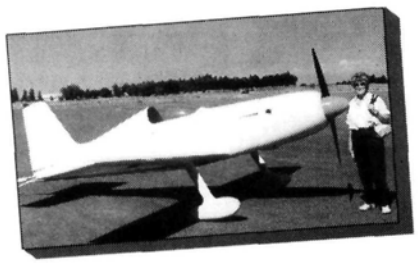
Part nos.—608 (connector), 609 (wrench).

Du-Bro Products Inc., P.O. Box 815, 480 Bonner Rd., Wauconda, IL 60084; (708) 526-2136.

Descriptions of products appearing in these pages were derived from press releases by the manufacturers and/or their advertising agencies. The information given here does not constitute endorsement by **Model Airplane News**, nor guarantee product performance. When writing to the manufacturer about any product described here, be sure to mention that you read about it in **Model Airplane News**.

Manufacturers! To have your products featured here, address the press releases to **Model Airplane News,** attention: Julie Soriano.

by JEF RASKIN



WHY IT GOES SO FAST

Subject: *Mike Arnold's speed-record setting AR-5, and how he did it.*
Source: *The Arnold Co., 5960 S. Land Park Dr. #361, Sacramento, CA 95822*
Summary: *One of the most interesting videos yet: clear, helpful, fascinating.*
List price: *$39.95*
Rating: ✈ ✈ ✈ ✈ ✈
Approximate length: *73 minutes*

Aviation has had many "holy grails": the first powered flight, the first solo crossing of the Atlantic, the first faster-than-the-speed-of-sound flight, the first round-the-world flight, the first "unrefueled" around-the-world flight, and so on. Another objective has been the creation of a piloted airplane with less drag than a 1-foot-square object (like a large floor tile) held flat to the wind. If such a plane could be built, it should be able to go 200mph on a tiny, 65hp engine. For comparison, 65 horses dragged the Piper Cub J4-A into the air and, on a good day when the stopwatch was running a tad slowly, to a top speed of about 100mph.

This video recounts the story of how Mike Arnold, no rocket scientist but an experienced airplane builder who isn't afraid to do his homework, inadvertently achieved that goal. He was actually on a different quest: the world speed record for planes weighing less than 661 pounds (300 kilograms), all-up weight. His AR-5, fueled and with the pilot aboard, scaled out at 660.2 pounds.

There's nothing revolutionary about the AR-5's design: it is a conventional tail-dragger with (surprise) fixed landing gear. It doesn't even have a spinner to cover the large, round opening at the front; it did, initially, but removing the spinner didn't slow the plane down at all.

What *is* special about the AR-5 is its superb craftsmanship and the attention to detail Arnold applied to nearly every possible source of drag. This is where the tape is especially valuable to model designers and builders: Arnold and aerodynamics expert Bruce Carmichael explain exactly what was done and why in an extremely clear and non-technical manner that we can all learn from.

Arnold gives a great deal of credit to books—often, the very same books we modelers have relied on and loved for years, including Abbot and von Doenhoff's "Theory of Wing Sections" (available in an inexpensive Dover edition) and Hoerner's classic and very-easy-to-apply book with the scary title, "Fluid Dynamic Drag."

Fascinating sub-plots abound: the weatherwise preparation (test flights showed that the plane was fastest when the air temperature was 75 degrees Fahrenheit.); worrisome clouds of insects and the blizzard of paperwork. We are given lots of details: the coefficient of drag for a P-51 in racing trim is about .0040, but the AR-6 manages .0038. Gliders can do better, but they don't have an engine to cool.

The script for the tape is well-organized, and everything is presented in a logical, coherent way. This is no fancy production—a few titles clarify and add detail as necessary—but the content more than carries the day.

Besides its educational value, the tape is fun to watch, and we cheer with Mike's friends as the data is compiled and he announces a world speed record of over 213mph! This tape is highly recommended and a must-see for designers and racers. I loved it; so did my 9-year-old son; and I think you will, too.

A second tape in the series ($49.95; both for $79.90), not reviewed here, discusses the structural design and the foam-and-fiberglass "moldless" construction process used to make the AR-5.

LET'S GET SERIOUS ABOUT ELECTRIC FLIGHT

Subject: *The current state of electric-powered R/C models*
Source: *Astro Flight Inc., 13311 Beach Ave., Marina del Rey, CA 90292*
Summary: *If you still think electric planes can only make brief anemic hops into the air, this tape will set you straight. Great flying; useful details.*
List price: *$9.95 (plus $1 S&H)*
Rating: ✈ ✈ ✈ ✈ ✈
Approximate length: *35 minutes*

My brother Michael loves airplanes as much as I do, but does not fly. One of his reasons is all the hassle, mostly with motors and the *ook* they generate. For years, he has watched me fly, unimpressed. But on a recent visit, I took him out to a local church parking lot, took out my Midwest Electric Hots, effortlessly taxied it out and took off.

Doing a half roll off the deck, I rapidly climbed inverted to a safe altitude and flew some aerobatics. The landing was reasonably smooth, and I taxied back, demonstrating the flawless motor control electrics offer. I slipped in another battery and did it all again. "That's what I've always dreamed an R/C flying session should be like," he said, as I put the still-spotless plane back in the trunk. Amen, brother.

I used to wish I could do demos for every unbeliever, but now I can just tell them to watch this tape. Electric R/C has come of age; it is no longer a poor cousin to the infernal combustion engine. The how's and why's are clearly explained by Bob Benjamin, who is a first-rate builder and flier, and who communicates clearly and well. While Astro Flight products are prominently mentioned, this is appropriate since they are a leader in the field. It is safe to say that without Astro Flight founder Bob Boucher's contributions to our sport, R/C electrics would be years behind where they now are. This tape does not exaggerate. The flight times cited are what you can readily achieve

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with today's technology, and you can see the power and maneuverability of these planes for yourself.

Mr. Benjamin demonstrates that rough grass fields are no problem; neither are floats. He does takeoffs, landings, and touch-and-goes from the water. He points out that it's nice to know that your engine isn't going to flame out 40 feet from the dock.

The tape correctly tells us that high-end electric systems cost no more than good internal-combustion engines and that the fuel is a lot cheaper. Not mentioned is that there are some very low-cost systems that fly very well, as my first Hots proved. I would have liked to have seen the inexpensive stuff mentioned to encourage beginners who don't want to sink a lot of money into the engine. When they find out how much fun no-needle-valve, no-starting, no-noise flying can be, they will want the better stuff. My second and third Electric Hots have Astro Cobalt motors, and perform even better.

If you neither believe that electrons have enough zip to move an airplane with authority, nor are a convinced electric flier who wants to sell the idea to fellow modelers, this tape will do the job. Astro Flight has done the hobby another service in making this tape available. ■

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